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T-BERD 310 COMMUNICATIONS ANALYZER USER'S MANUAL
FOR THE 310-S USER INTERFACE

SEPTEMBER 1999

This manual addresses the T-BERD 310 for use with the T-BERD 310 Revision M-S.XX or earlier software

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Sincerely,

John Peeler

John Peeler
President and CEO

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SECTION 1
GETTING STARTED

1.1 INTRODUCTION

This section provides an overview of the Telecommunications Techniques Corporation (TTC) T-BERD 310 Communications Analyzer. It gives information on available TTC options, accessories and cables, instrument setup and checkout procedures, and maintenance and service information. Refer to Section 2 for more information on the front- and side-panel controls, indicators, and connections.

1.2 INSTRUMENT OVERVIEW

The T-BERD 310 is a portable test instrument that can test and analyze SONET, DS3, and DS1 transmission systems from SONET, DS3, and DS1 access points during circuit installation, acceptance testing, and fault isolation. The T-BERD 310 can generate and receive test patterns for out-of-service testing, or monitor SONET, DS3, and DS1 circuits without service interruption. Options can be added that enable the T-BERD 310 to perform DS1 testing, drop and insert a DS1 channel on a live DS3 line, drop E1 channels, drop and insert OC-3, OC-3c, DS3 and DS1 payloads on SONET signals, and perform optical media tests. The instrument can also be optioned to test and analyze ATM traffic on SONET, DS3 and DS1 transmission systems.

The following information describes the standard and optional features for the T-BERD 310.

1.2.1 Standard Features

The T-BERD 310 offers the following standard features:

DS3 Pulse Shape measurement quickly isolates cable faults that are not readily evident through traditional BERT tests. Intermittent errors on DS3 hand-offs are commonly caused by improper or loose crimps or degraded or damaged coaxial cable. Pulse Shape measurements can also identify when too much or too little coax has been installed, or if the line build-out has been improperly set. These types of errors can be the most time consuming for field technicians to find and often result in "No Problem Found" resolutions leading to poor customer service or future call-backs.

Enhanced user interface provides easy to use controls and indicators designed to focus on DS3, SONET, and ATM circuit testing.

Multiplexed C-bit parity and M13 framed operating modes enable the T-BERD 310 to insert DS1 D4 or ESF formatted test patterns or loop codes into the DS3 signal.

Automatic configuration mode allows the T-BERD 310 to configure itself automatically to the received DS3 signal framing and pattern.

Standard and programmable DS3 test patterns are selectable from a front-panel switch.

Five side-panel DS3 outputs provide the same signal as the front-panel output jack.

Simultaneous test result accumulation minimizes the time needed to test for DS1, DS3, or SONET signals.

A summary test results category displays key non-zero and "out-of-spec" test results, eliminating the need to search through long lists of test results.

Pattern slips can be counted between the transmitted and received signal by testing the circuit with pseudorandom test patterns.

Logic error, BPV, and frame error insertion capabilities enable the T-BERD 310 to simulate errors as they occur. Errors can be inserted singly, in bursts at preselected durations and error rates, or continuously at preselected error rates.

Connecting a printer to the T-BERD 310 allows generation of test results, signal status and alarm messages, front-panel switch configurations, and pulse shape graphs. The T-BERD 310 comes equipped with an RS-232-C serial interface or optional IEEE-488 interface (IEEE-488 Option).

An internal print buffer allows printouts to be stored until a printer is connected to the T-BERD 310. The print buffer is battery-backed which allows power to be turned off without losing the printout information.

Customized test result printouts can be created for specific tests.

Remote control operation enables the T-BERD 310 to be installed at a remote location or in a manufacturing test facility. An RS-232-C serial interface or optional IEEE-488 interface (IEEE-488 option) is available for remote control operation.

Multiple displays enable the operating mode, test pattern, and two test results to be displayed on the user interface at the same time.

Audible alarms can be used to indicate pattern synchronization, threshold errored seconds, and any other error event.

DS1 channels can be dropped from a DS3 signal to the DS1/DS0 Analyzer Option or an external DS1 test set.

DS2 frame synchronization and loss detection LEDs provide status and alarm indications on the user interface.

Far-end alarm and control (FEAC) messages can be monitored and displayed on the user interface and reported in a printout. FEAC messages can also be selected and transmitted from the T-BERD 310.

1.2.2 Optional Features

Table 1-1 lists optional features for the T-BERD 310. Unless otherwise indicated, the T-BERD 310 can be upgraded in the field with one or more of the options. Contact TTC at (800) 638-2049 for additional information on upgrading the T-BERD 310.

Table 1-1. T-BERD 310 Options

Option	Description
310-1 DS1/DS0 Analyzer Option	Allows test and analysis of DS1 and DS0 channels from either a SONET, DS3 or DS1 access point. All 28 DS1s can be scanned from either a SONET or DS3 signal for frame synchronization, frame loss, frame errors, CRC errors, timing slips, and alarms. A user interface is housed in the T-BERD 310 front cover allowing easy access and control over the DS1/DS0 analyzer. This option provides DS1 (input and output), datalink (ESF and SLC), DS0, and VF signal access through the side panel. Refer to Section 2.12 for additional information. User-installed option.
310-3 DS1 Insert/Secondary DS3 Receive Option	Enables the T-BERD 310 to insert a DS1 channel into a live DS3 signal without affecting the DS3 signal or the other 27 DS1 channels. This option provides a secondary DS3 receiver and a DS1 input. The secondary DS3 receiver allows the DS3 signal to pass through the T-BERD 310 and accommodate the insertion of the DS1 channel. The secondary DS3 signal can be monitored from the user interface and tested for in-service BPV, frame, M13 parity, C-bit parity, FEBE errors, and the received frequency. The secondary DS3 receiver also enables the T-BERD 310 to perform full-duplex (bidirectional) in-service monitoring of a DS3 line. The DS1 input allows a DS1 channel to be inserted from an external DS1 source. A DS1 channel can also be inserted from the DS1/DS0 Analyzer Option. Refer to Section 2.19 for additional information. User-installed option.
310-5 DS3 Jitter Option	Enables the T-BERD 310 to measure the DS3 signal for wideband and highband jitter. The option provides test results that measure the current wideband and highband peak-to-peak jitter and the maximum wideband and highband peak-to-peak jitter since the start of the test. The results are presented in unit intervals (UIs). The option also provides an output that can drive an external spectrum analyzer to determine the amplitude and frequency components of the jitter. Refer to Section 2.25 for additional information. User-installed option.
310-9B Enhanced DS1 Testing Option	Adds the following functions to the DS1/DS0 Analyzer Option. This option obsoletes the 310-9A option. User-installed option. • Tests and analyzes the ESF datalink ANSI T1.403 performance report messages (PRM). • Generates PRMs on the transmitted signal which are based on the received DS1 signal. • Generates ESF out-of-band loop codes. • Adds the DS1 timing slip test result that enables the DS1/DS0 Analyzer Option to measure bit and frame slips between two DS1 signals. • Adds Fractional-T1 testing. • Adds long user patterns (LUP). • Adds an ESF datalink timing synchronization message test result. • Refer to Section 2.12 for additional information.
310-10 G.821 Results Option	Adds the ITU-T Recommendation G.821 performance analysis test results to the T-BERD 310 and DS1/DS0 Analyzer Option. The G.821 results include available seconds, % available seconds, severely errored seconds (except 310-1), % severely errored seconds, consecutive severely errored seconds (except 310-1), degraded minutes, % degraded minutes, and unavailable seconds. Refer to Section 2.91.2 (DS3 testing) or 2.104.2 (DS1 testing) for additional information. User-installed option.
310-11 Three Slot Expansion Option	This T-BERD 310 chassis provides three additional PC board slots for a fully optioned T-BERD 310. Without this option, up to three of the following options can be installed: 310-1, 310-3, 310-5, 310-12 or 310-16.
310-12 SONET OC-12, OC-12c Transmit/Receive Option	Provides both SONET transmit and receive signals. Two versions of this option are available: 1300 nm transmit wavelengths (310-12-1300), and 1300 nm/1550 nm transmit wavelength (310-12-DUAL) OC-12c, OC-3c, DS3, and DS1 payload drop and insert, and through mode capabilities at the OC-12 rate. The 310-14R and 310-14T pair (310-14R/T pair) option is required to support this option. Refer to Section 2.30 for additional information. User-installed option.

Table 1-1. T-BERD 310 Options (Continued)

Option	Description
310-13R SONET STS-1 Receive Option	Provides SONET receive signal input and DS3 or DS1 payload drop capabilities at the STS-1 rate. SONET DCC drop and insert (310-13T required) capabilities are also provided. Refer to Section 2.30 for additional information. User-installed option.
310-13T SONET STS-1 Transmit Option	Provides SONET transmit signal output and DS3 or DS1 payload insert capabilities at the STS-1 rate. SONET orderwire drop (310-13R required) and insert capabilities and a DS1 BITS clock input are also provided. Two versions of this option are available: 1300 nm transmit wavelength (310-12-1300), and 1300 nm/1500 nm transmit wavelength (310-12-DUAL). Refer to Section 2.30 for additional information. User-installed option.
310-14R SONET STS-1, OC-1/3/3c Receive Option	Provides SONET receive signal inputs and OC-3c (OC-3 only), DS3, or DS1 payload drop capabilities at the STS-1, OC-1, and OC-3 rates. SONET DCC drop and insert (310-14T required) capabilities are also provided. Refer to Section 2.30 for additional information. User-installed option.
310-14T SONET STS-1, OC-1/3/3c Transmit Option	Provides SONET transmit signal outputs and OC-3c (OC-3 only), DS3, or DS1 payload insert capabilities at the STS-1, OC-1, and OC-3 rates. SONET orderwire drop (310-14R required) and insert capabilities and a DS1 BITS clock input are also provided. Two versions of this option are available: 1300nm transmit wavelength (310-14T-1300), and 1300 nm/1550 nm transmit wavelengths (310-14T-DUAL). Refer to Section 2.30 for additional information. User-installed option.
310-15 OC-3c ATM Analysis Option	Provides asynchronous transfer mode (ATM) test functionality at the OC-3c rate for the SONET options: 310-14R/T. Refer to Section 2.36 for additional information. User-installed option. Two versions of this option are available: 1300 nm transmit wavelength (310-12-1300), and 1300 nm nm/1500 nm transmit wavelengths (310-12-DUAL).
310-16 Optical Media Test Option	Enables the T-BERD 310 to measure optical power and return loss on a fiber optic cable. The card also provides a stable laser source to perform end-to-end insertion loss measurements. Refer to Section 2.45 for additional information. User-installed option.
310-17A DS1/DS3 ATM Analysis Option	Enables DS1/DS3 ATM level testing. Refer to Section 2.36 for additional information. User-installed option.
310-18 Manufacturing Software Option	Enables SONET overhead byte manipulation and a SDH STM-1 test mode. Refer to Section 2.48 for additional information. User-installed option. Formally SONET Byte Manipulation Option.
310-19 Internal Modem Option	Adds a full-duplex auto-answer internal modem to the T-BERD 310. The modem operates over a 2-wire dialup line at data rates up to 9600 b/s. Additional features include: AT command set compatible, built-in analog test capabilities, RJ-11 connection, and speaker. Refer to Section 2.52 for additional information. User-installed option.
310-20 OC-12c ATM Analysis Option	Provides full-bandwidth, asynchronous transfer mode (ATM) signal generation and/or reception and analysis capabilities at the OC-12c rate. Refer to Section 2.36 for additional information. User-installed option.
310-21 SONET OC-48, OC-48c Transmit/Receive Option	Provides both SONET transmit and receive signals. Three versions of this option are available: 1300 nm transmit wavelength (310-21-1300), 1550 nm transmit wavelength (310-21-1550), and 1300 nm/1550 nm transmit wavelengths (310-21-DUAL) OC-48c, OC-12c, DS3, and DS1 drop and insert and thru mode capabilities at the OC-48 rate. The 310-12 options are required to support this option. Refer to Section 2.30 for additional information. User-installed option.
310-22 DWDM Channel Monitor Option	Provides dense wavelength division multiplexing (DWDM) optical physical layer analysis. This option tests multiple signals over a single fiber optics cable as they pertain to signal-to-noise, total power, and center wavelength. Refer to Section 2.56 for additional information. User-installed option.

1.3 UNPACKING AND INITIAL INSPECTION

The T-BERD 310 shipping container should be inspected for the equipment included with the shipment (see Section 1.4) and for any signs of damage. If the shipping container or shipping material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument is checked mechanically and electrically. The electrical performance of the instrument can be checked by per-

forming the instrument checkout procedure in Section 1.8. If the contents of the shipment are incomplete or if the T-BERD 310 does not pass the checkout procedure, notify TTC Customer Service at (800) 638-2049. If the shipping container is damaged, notify the carrier and TTC. Keep the shipping container and materials for the carriers inspection.

1.4 EQUIPMENT INCLUDED

The following items should be present when the T-BERD 310 is received and unpacked.

- T-BERD 310 Communications Analyzer with front-panel cover
- 3-prong AC line cord
- T-BERD 310 User's Manual
- 1-foot loopback cable
- Snap-on pouch

Check the purchase order against the rear-panel option stickers to verify that the ordered options are installed.

1.5 WARNINGS

The following warnings must be observed before and during all phases of instrument operation. Failure to comply with these and other specific warnings contained elsewhere in this manual may cause physical harm to the operator and/or damage to the instrument. TTC assumes no liability due to the customers failure to comply with these requirements.

GROUND THE INSTRUMENT
To minimize shock hazard, the instrument chassis must be connected to an approved 3-contact electrical outlet or used with a 3-contact to 2-contact adaptor with the grounding wire firmly connected to an electrical ground at the power outlet.

KEEP AWAY FROM LIVE VOLTAGES
Do not remove the instruments top cover or insert fingers or other objects through the side panel holes while power is applied.

DO NOT OPERATE IN AN AMBIENT TEMPERATURE ABOVE 113°F (45°C)
Do not operate the instrument in ambient temperatures that exceed 45°C. Operating this unit in temperatures above 45°C can cause damage to the instrument.

REPLACE BLOWN AC FUSE WITH A PROPERLY RATED FUSE
Do not operate the instrument with an improperly rated AC fuse. An improperly rated fuse can result in damage to the instrument. Additionally, there is a second fuse located in the AC receptacle of the unit.

1.6 POWER REQUIREMENTS

T-BERD 310 units are configured with a single phase, auto-sensing 115/220 VAC, 50/60 Hz power supply. The power supply automatically accepts either voltage source. Refer to Section 1.9.2 for more information on fuse requirements and replacement.

1.7 SETTING UP THE T-BERD 310

The following procedure describes how to setup the T-BERD 310.

1.7.1 Opening the T-BERD 310

Perform the following procedure to open and apply power to the T-BERD 310.

1. **Set instrument on flat surface**
2. **Raise front of instrument (see Figure 1-1)**
   Extend the two bottom front feet to raise the user interface up for better viewing and allow the front cover to be opened.
3. **Press down on two front-cover buttons and open cover**
   The cover is designed to lay flat on the table while still attached to the instrument. If the DS1/DS0 Analyzer Option is installed in the cover, the cover should remain attached to the instrument.
4. **Connect AC power cord to side panel**
   Verify **AC Power** switch is set to OFF ("0" side down) before connecting the power cord to an AC outlet.
5. **Press AC power switch ("1" side down) to turn power ON**
   During an initial power-up sequence, the instrument performs a diagnostic self-test described in Section 1.7.2.

1.7.2 Power-Up Self-Test

The instrument performs the following diagnostic self-test upon power-up:

- The message *SELF TEST* appears in the display and all of the user interface LEDs momentarily illuminate. This provides a visual inspection of the LEDs. If an LED is burned out, make note of it. A burned-out LED does not affect normal operation, but should be repaired to avoid confusion and inconvenience.
- The mainframe software version number appears.
- All user interface switches are checked. If a switch is found to be stuck in an active position, a message is displayed (see Appendix A) indicating a switch is stuck. A switch identified as stuck becomes inoperative, but should be repaired to make its related functionary available to the user.
- The instrument configuration stored in NOVRAM is checked. If the data has not changed since the last power down, the instrument is configured accordingly. If options are installed, removed, or software is changed, NOVRAM is automatically reloaded; this is normal and is not a cause for concern. If errors are found in the NOVRAM data, the message *RELOADING NOVRAM* appears, the factory default settings are reloaded, and the user interface is configured accordingly. The T-BERD 310 remains fully functional even though the instrument configuration may not have been saved during the power cycle. While the instrument may be used, TTC should be called for service at (800) 638-2049.

- The internal components are checked. If faults are found in the internal components, specific messages are displayed. In the event that a self-test error message is displayed, record the message and call TTC for assistance. There are no user-serviceable parts in the T-BERD 310, except the fuse located on the side panel.
- The pulse shape measurement capability is calibrated.

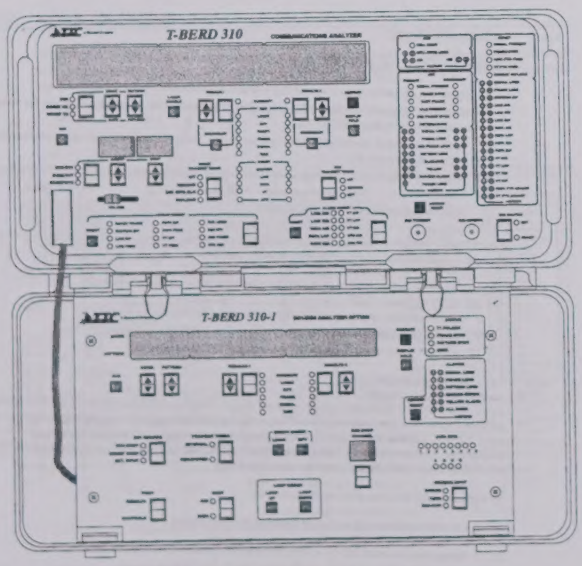


Figure 1-1. Opening the T-BERD 310

1.7.3 Reloading NOVRAM with Factory Defaults

During power up two functions can be performed, reloading NOVRAM with the factory default settings, and checking the current software and hardware versions installed in the test set.

To reload NOVRAM with the factory default settings, press and hold the **RESTART** switch while turning the power on (press **AC Power** switch). Release the **RESTART** switch when the message *RELOADING NOVRAM* appears (up to 35 seconds) to allow the power-up sequence to continue. If the **RESTART** switch is pressed too long the message *STUCK KEYS DETECTED* appears. Release the switch and the power-up sequence continues. When the power-up self-test is completed, the user interface should look like Figure 1-2.

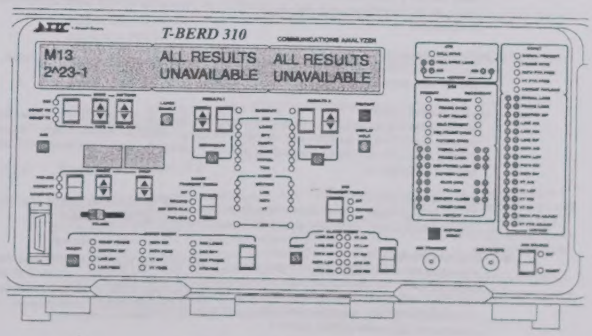


Figure 1-2. User Interface After Power-Up

1.7.4 Checking T-BERD 310 Configuration

To display the current software and hardware versions, press the **MODE** switch during power up as illustrated in the following steps. The displayed information may appear differently depending the T-BERD 310 configuration.

1. **Press and hold MODE switch down arrow for 5 to 35 seconds while turning power on**
   The following information appears.

SW Version: M-S	HARDWARE REVISIONS:
(c) TTC 3/16/1998	use MODE to scroll

2. **Release MODE switch**
   Release the switch and the first hardware revision appears.

SW Version: M-S	PROCESSOR BOARD
(c) TTC 3/16/1998	Module code = 01

3. **Press MODE switch down arrow**
   Press successive times to scroll through list of installed boards and options.

```
SW Version:  M-S        I EEE488 OPTION
(c) TTC 5/16/1997       Installed
```

```
SW Version:  L-S        G.821 RESLTS OPTION
(c) TTC 3/16/1998       Not installed
```

4. **Press MODE switch down arrow**
   After the last hardware revision scrolls by, the power-up sequence continues with the software version displayed and the front-panel LEDs illuminating.

```
SW Version:  M-S
(c) TTC 3/16/1998
```

The status of the PC boards and options is indicated below the name as a module code or whether they are installed or not. This provides useful information about the T-BERD 310 configuration if a problem occurs with the instrument.

1.8 INSTRUMENT CHECKOUT

After unpacking, the T-BERD 310 should be checked for proper electrical operation. If any of the following steps fail, repeat the step. If the procedure continues to fail, contact TTC Customer Service at (800) 638-2049.

1.8.1 T-BERD 310 Mainframe Checkout

Perform the following checkout procedure to verify the proper operation of the T-BERD 310 mainframe.

1. **Instrument setup**
   Perform the procedure in Section 1.7.1 to set up the instrument. In Step 5 of Section 1.7.1, press and hold the **RESTART** switch while applying power to the instrument to configure the instrument with the factory default settings.

2. **Power-up self-test**
   Refer to Section 1.7.2 to verify successful power-up. If an error message appears during the self-test procedure, refer to Appendix A for corrective action.

3. **DS3 loopback cable**
   Plug the supplied loopback cable into the front-panel DS3 TRANSMIT and DS3 RECEIVE jacks.

4. **RESTART switch**
   Press switch to clear any results appearing in the RESULTS windows and to restart the test.

5. **DS3 Primary Status LEDs**
   Verify the green DS3 Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate and the RESULTS windows indicate *ALL RESULTS OK*.

6. **Unplug loopback cable**
   Verify the DS3 Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — are *not* illuminated. The RESULTS windows may indicate errors, e.g., BIT ERRORS. The red DS3 Primary Alarm LEDs — Signal Loss, Frame Loss, and Pattern Loss — illuminate (right column of LEDs under Primary Alarms).

7. **Plug in loopback cable**
   Verify the DS3 Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate. The RESULTS windows may indicate errors, e.g., BIT ERRORS (an increase in the count may occur). The DS3 Primary Alarm LEDs — Signal Loss, Frame Loss, and Pattern Loss — are *not* illuminated. However, the DS3 Primary Alarm History LEDs — Signal Loss, Frame Loss, and Pattern Loss — are illuminated (left column of LEDs under Primary Alarms).

8. **RESTART switch**
   Press switch to clear any results appearing in the RESULTS windows, the DS3 Primary Alarm History LEDs, and restart the test. Verify the DS3 Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate and the RESULTS windows indicate *ALL RESULTS OK*.

9. **ERROR INSERT switch**
   Press switch for less than 1 second. A single logic error is inserted into the transmitted signal. Verify the receipt of the logic error in the RESULTS windows. The logic error can appear in the BIT ERRORS, PAR ERRORS, or FRM ERRORS test result. If the test result is not in the RESULTS I window, press the **RESULTS I Results** switch (**RESULTS I** switch with arrows) to scroll through the SUMMARY category. Press the **ERROR INSERT** switch several more times to increment the error count.

10. **RESULTS I Results switch**
    Press switch to verify the test results are displayed and make note of any others. The SUMMARY results category displays specific non-zero or out-of-specification results.

11. **Test complete**
    The T-BERD 310 mainframe is performing properly. Remove loopback cable and if necessary turn power off.

1.8.2 SONET Option Checkout

Perform the following checkout procedure to verify the proper operation of the T-BERD 310 SONET options (310-12, 310-13R/T, 310-14R/T or 310-21).

1. **Instrument setup**
   Perform the procedure in Section 1.7.1 to set up the instrument. In Step 5 of Section 1.7.1, press and hold the **RESTART** switch while applying power to the instrument until the "RELOADING NOVRAM..." message appears to configure the instrument with the factory default settings.

2. **Power-up self-test**
   Refer to Section 1.7.2 to verify successful power-up. If an error message appears during the self-test procedure, refer to Appendix A for corrective action.

3. **Loopback cable**
   Plug the supplied loopback cable into the side-panel STS-1 TRANSMIT and STS-1 RECEIVE jacks.

4. **DS3 SOURCE switch**
   Press switch to select SONET.

5. **RESTART switch**
   Press switch to clear any results appearing in the RESULTS windows and to restart the test.

6. **SONET LEDs**
   Verify the SONET Status LEDs — Signal Present, Frame Sync, and Path PTR Pres — illuminate, and the RESULTS windows indicates *ALL RESULTS OK*. None of the SONET Alarm LEDs should be illuminated.

7. **Verify DS3 Status LEDs**
   Verify the DS3 Status LEDs — Signal Present, Frame Sync, and Pattern Sync — are illuminated, and that no Alarm LEDs are illuminated.

8. **Unplug loopback cable**
   Verify the SONET Status LEDs — Signal Present, Frame Sync, and Path PTR Pres — are *not* illuminated. The RESULTS windows may indicate errors (press **RESULTS I Results** switch). The red SONET Alarm LEDs — Frame Loss and Signal Loss — should illuminate (right column of LEDs under SONET Alarms).

9. **Verify DS3 Alarm LEDs**
   Verify the DS3 Signal Present LED remains illuminated, (this LED illuminates because of a DS3 Idle Signal). The red Frame Loss and Pattern Loss LEDs should also be illuminated.

10. **Plug in loopback cable**
    Verify the SONET Status LEDs — Signal Present, Frame Sync, and Path PTR Pres — illuminate. The RESULTS windows may indicate errors (e.g., SONET Alarm: LOS, SONET Alarm: LOF, BIT ERRORS, etc.). The SONET Alarm LEDs — Frame Loss and Signal Loss — are *not* illuminated. However, the SONET Alarm History LEDs — Frame Loss and Signal Loss — are illuminated (left column of LEDs under SONET Alarms).

11. **RESTART switch**
    Press switch to clear any results appearing in the RESULTS windows, the DS3 Primary Alarm History LEDs, and to restart the test. Verify the green DS3 Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync— illuminate and the RESULTS windows indicate *ALL RESULTS OK*.

12. **ERROR INSERT switch**
    Press switch for less than 1 second. A single logic error is inserted into the transmitted DS3 signal. Verify the receipt of the logic error in the RESULTS windows. The logic error can appear in the BIT ERRORS, PAR ERRORS, or FRM ERRORS test result. If the test result is not in the RESULTS I window, press the **RESULTS I Results** switch (**RESULTS I** switch with arrows) to scroll through the SUMMARY category. Press the **ERROR INSERT** switch several more times to increment the error count.

13. **RESULTS II switches**
    Press the left **RESULTS II Category** switch to select the SECTION results category. Press the **RESULTS II Results** switch (switch with arrows) until the SON TX FREQ test result appears in the RESULTS II window. Verify the test result indicates a transmit frequency of approximately 51840000 Hz.

14. **Test complete**
    The T-BERD 310 SONET option is performing properly. Remove loopback cable and if necessary turn power off.

1.9 MAINTENANCE

This section describes the steps to take should you have trouble operating the T-BERD 310. Instructions for replacing the instrument line fuse are also included, along with a description of the TTC warranty policies and repair procedures.

1.9.1 In Case of Difficulty

If the T-BERD 310 fails to operate and no front-panel indicators illuminate:

- Check the AC power cord to ensure that it is securely connected to the T-BERD 310.
- Make sure the power supply is uninterrupted by plugging another electrical device into the electrical outlet used by the T-BERD 310.
- Verify that a proper, working AC line fuse is installed. Information on the fuse-type and installation is given in Section 1.9.2.
- Verify that factory default settings were restored prior to instrument checkout. Refer to Section 1.8.1.
- Verify that all cables are installed properly.

If the T-BERD 310 fails to operate after determining the AC power cord, power source, and fuse are working properly, contact the TTC Customer Service at (800) 638-2049.

If the user interface indicators illuminate, but the instrument does not operate properly:

- Use the instrument checkout procedure in Section 1.8 to localize the problem.
- Note the areas where the self-test failed, then contact TTC for assistance.

1.9.2 AC Line Fuse Replacement

The T-BERD 310 AC line fuse is stored in the AC fuse receptacle located just below the **AC Power** switch. Additionally, there is a second fuse located nearby that can be used as a backup if the first one becomes open; however, the user must manually remove the blown fuse from the receptacle and replace it with the backup fuse. Anytime the fuse is open, it should be replaced with a 5A, 250V, SLO-BLO fuse (Littlefuse #218001 or equivalent). Always use the correct fuse rating.

To replace the AC line fuse, perform the following:

1. **Locate fuse cover tab above AC Power switch receptacle**
2. **Using small screwdriver or similar instrument, gently pry fuse cover open**
3. **Remove old fuse and install new fuse of the correct size**
4. **Press plastic fuse holder securely back into place**

SECTION 2
INSTRUMENT DESCRIPTION

2.1 INTRODUCTION

This section describes the controls, indicators, connections, and test results used to set up and operate the T-BERD 310 mainframe (see Figure 2-1) and the available options.

The T-BERD 310 mainframe is described first, and then the major options are described afterwards in separate sections as follows:

- DS3 Testing
- E-1 Drop
- 310-1 DS1/DS0 Analyzer Option
  - 310-9B Enhanced DS1 Testing Option
- 310-3 DS1 Insert/Secondary DS3 Receive Option
- SONET Options
  - 310-12 SONET OC-12/12c Transmit/Receive Option (two options available)
  - 310-13R SONET STS-1 Receive Option
  - 310-13T SONET STS-1 Transmit Option
  - 310-14R SONET STS-1, OC-1/3/3c Receive Option
  - 310-14T SONET STS-1, OC-1/3/3c Transmit Option (two options available)
  - 310-21 SONET OC-48/48c Transmit/Receive Option (three options available)
- 310-5 DS3 Jitter Option
- 310-15 OC-3c ATM Analysis Option
- 310-16 Optical Media Test Option
- 310-17A DS1/DS3 ATM Analysis Option
- 310-18 Manufacturing Software Option (formerly SONET Byte Manipulation Option)
- 310-19 Internal Modem Option
- 310-20 OC-12c ATM Analysis Option
- 310-22 DWDM Channel Monitor Option
- Mainframe Auxiliary Functions
- DS1/DS0 Analyzer Option Auxiliary Functions
- Mainframe Test Results
  - 310-10 G.821 Results Option
- DS1/DS0 Analyzer Option Test Results

After the options are described, complete descriptions of the auxiliary functions and test results are also separated into subsections.

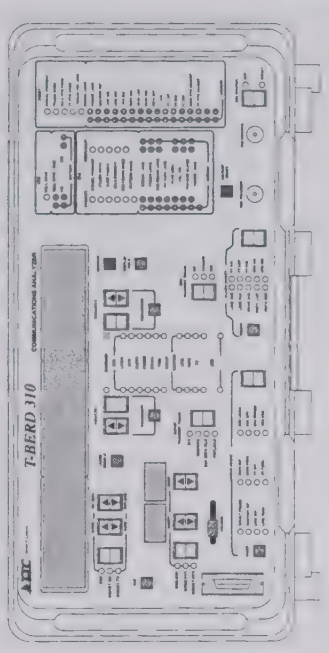


Figure 2-1. T-BERD 310 Front Panel

DS3 TESTING

2.2 INITIAL TEST SETUP

The following controls and indicators (see Figure 2-2) are used to initially configure the T-BERD 310 to test a circuit from a DS3 access point. The controls and indicators are described in the order that you would normally use them.

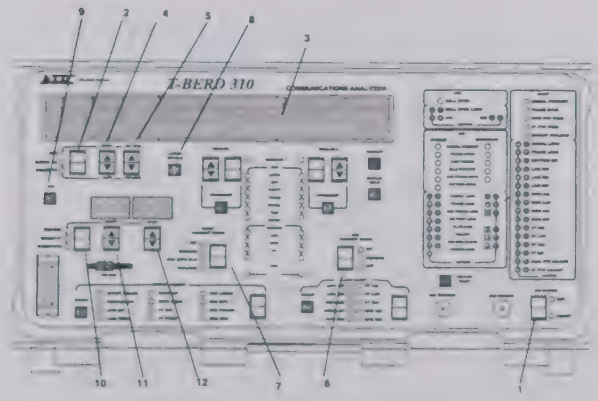


Figure 2-2. DS3 Test Setup Controls and Indicators

2.2.1 DS3 SOURCE Switch [1]

The **DS3 SOURCE** switch selects the DS3 signal from either a side-panel SONET input signal or front-panel DS3 input signal. The switch is functional only when a SONET receive option is installed. The switch selections include:

EXT — Selects the DS3 RECEIVE connector as the DS3 input source.

SONET — Selects the internal DS3 signal dropped from one of the side panel SONET input connections as the DS3 source.

2.2.2 SETUP Switch [2]

The **SETUP** switch selects the way mode and test pattern information is changed and displayed on the left display window. This switch is functional only when the appropriate SONET options are installed. The switch selections include:

DS3 — Uses the **MODE/RATE** and **PATTERN/PAYLOAD** switches to effect changes to the DS3 transmit and receive signals.

SONET RX — Available only with a SONET receiver option installed. Refer to Section 2.30 for information on the SONET options.

SONET TX — Available only with a SONET transmitter option installed. Refer to Section 2.30 for information on the SONET options.

2.2.3 Front-Panel Display [3]

Operating modes, test patterns, results, and auxiliary functions are viewed in the display shown in Figure 2-2. The display is divided into three 2-line windows. The left window indicates the current operating mode and test pattern. The operating mode and test pattern are selected by pressing the **MODE/RATE** and **PATTERN/PAYLOAD** switches. The other two windows, identified as RESULTS I and RESULTS II, display the results and instrument status messages. The RESULTS windows are controlled by the **RESULTS** switches.

All three windows of the front-panel display are used to configure auxiliary functions (**AUX** switch illuminates). The selected auxiliary group and function name are indicated in the left MODE/PATTERN window. The other two windows indicate the available selections for the auxiliary function.

2.2.4 MODE/RATE Switch [4]

NOTE

This section describes using the **MODE/RATE** switch for DS3 testing. Refer to Section 2.30 for information on using this switch with a SONET option.

The operation of the **MODE/RATE** switch depends on the setting of the **SETUP** switch.

- When **DS3** is selected, the **MODE/RATE** switch selects the DS3 transmit and receive framing mode for the T-BERD 310.
- When **SONET RX** is selected, the **MODE/RATE** switch selects the receive SONET input rate.
- When **SONET TX** is selected, the **MODE/RATE** switch selects the SONET output transmit rate.

When DS3 is selected, and the **AUX** switch is not activated, the **MODE** switch selects the DS3 transmit and receive framing for the T-BERD 310. This should match the framing received if the framing format is unknown, select the AUTO mode to allow the T-BERD 310 to autonomically analyze the received signal and configures itself accordingly.

Press the **MODE** switch to scroll through the available operating modes in the MODE window. Allowing the selected mode to be displayed for more than 3 seconds will cause the T-BERD 310 to start that mode and restart the test. Press the **MODE** switch to scroll out of the following modes:

M13 — Configures the T-BERD 310 to test non-channelized DS3 M13 formatted signals.

C-BIT — Configures the T-BERD 310 to test non-channelized DS3 C-bit parity formatted signals.

MUXED M13 — Configures the T-BERD 310 to generate a multiplexed (channelized) DS3 M13 signal. The multiplexed DS3 signal contains embedded DS2 and DS1 framing. DS1 level test patterns are selectable with the **PATTERN** switch. The test pattern is inserted into the desired DS1 channels using the **DS3-DS1 Channel Control-INSERT** switch.

MUXED C-BIT — Configures the T-BERD 310 to generate a multiplexed (channelized) DS3 C-bit parity signal. The multiplexed DS3 signal contains embedded DS2 and DS1 framing. DS1 level test patterns are selectable with the **PATTERN** switch. The test pattern is inserted into the desired DS1 channels using the **DS3-DS1 Channel Control-INSERT** switch.

DS1 INSERT — Appears when the DS1 Insert/Secondary DS3 Receive Option is installed (see Section 2.19).

THRU — Configures the receiver to scan and synchronize to the DS3 input signal framing and pattern information. The transmitter retransmits the received framing and pattern as it is received, including any errors (not BPVs). In THRU mode, the **DS3 TRANSMIT TIMING** switch defaults to RECOVD timing.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches (**DS3 LOGIC** and **DS3 BPV**).
- Full logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate DS3 Status LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but *live* data:

- The word *live* appears in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- BPVs can be inserted with the **ERROR INSERT** switches (**DS3 BPV**).
- Full BPV, parity, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate DS3 Status LEDs illuminate.

AUTO — Configures the receiver to scan and synchronize to the DS3 input signal framing and pattern information. After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. If signal loss occurs and then returns, press the **RESTART** switch to restart AUTO mode.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic errors, frame errors (with framed signal only), and BPVs can be inserted with the **ERROR INSERT** switches (**DS3 LOGIC, DS3 FRAME,** and **DS3 BPV**).
- Full LOGIC, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate DS3 Status LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but live data:

- The word *live* appears in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- Frame errors (with framed signal only), and BPVs can be inserted with the **ERROR INSERT** switches (**DS3 FRAME** and **DS3 BPV**).
- Full BPV, parity, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate DS3 Status LEDs illuminate.
- The **DS3 TRANSMIT TIMING** switch defaults to RECOVD.

UNFRAMED — Configures the T-BERD 310 to test unframed DS3 circuits.

2.2.5 PATTERN/PAYLOAD Switch [5]

NOTE

This section describes DS3 testing using the **PATTERN** switch. Refer to Section 2.30 for information on using the **PAYLOAD** switch with a SONET option.

The operation of the **PATTERN/PAYLOAD** switch depends on the setting of the **SETUP** switch as follows:

- When **DS3** is selected, the **PATTERN/PAYLOAD** switch selects the DS3 test pattern.
- When **SONET RX** is selected, the **PATTERN/PAYLOAD** switch selects the received SONET payload type.
- When **SONET TX** is selected, the **PATTERN/PAYLOAD** switch selects the transmitted SONET payload type.

When the **AUX** switch is not activated, the **PATTERN** switch selects the mode-specific test pattern transmitted by the T-BERD 310. The selected test pattern is also used to obtain pattern synchronization on the receiver. Press the **PATTERN** switch to scroll through the available test patterns in the PATTERN window. Table 2-1 lists the test patterns and their associated mode. Allowing the selected test pattern to be displayed for more than 0.5 seconds configures the T-BERD 310 for that test pattern and restarts the test.

Table 2-1. Mode Specific Test Patterns

Operating Modes	Patterns
AUTO, UNFRAMED, M13, and C-BIT	2^23-1, 2^20-1, 2^15-1, 1111, 1100 (IDLE)[1], 1010 (BLUE)[1], and USER1
MUXED M13 and MUXED C-BIT	T1D4 QRSS, T1D4 3/24, T1D4 1:7, T1D4 1004Hz, T1D4 LPUP, T1D4 LPDN, T1ESF QRSS, T1ESF 3/24, T1ESF 1:7, T1ESF 1004Hz, T1ESF LPUP, T1ESF LPDN
DS1 INSERT[2]	EXTERNAL DS1 and INTERNAL DS1[3]

1. IDLE and BLUE appear only for framed signals.
2. Requires the DS1 Insert/Secondary DS3 Receive Option.
3. Requires the DS1/DS0 Analyzer Option.

When the operating mode is changed, the displayed test pattern may not be valid for the new mode. In this case, the last valid test pattern for the selected mode is displayed. The mode-specific test patterns are divided into three groups: non-channelized, channelized, and DS1 Insert. The test patterns are described as follows:

Non-channelized test patterns — These patterns are non-channelized, i.e., they do not contain DS2 or DS1 framing. Unless otherwise indicated, the following DS3 test patterns can be transmitted in the M13, C-BIT, UNFRAMED, and AUTO modes.

2^23-1 — An 8,388,607-bit pseudorandom pattern which generates a maximum of 22 sequential zeros and 23 sequential ones. This pattern conforms to ITU-T Recommendation O.151.

2^20-1 — A 1,048,575-bit pseudorandom pattern which generates a maximum of 19 sequential zeros and 20 sequential ones. This pattern conforms with Bell Compatibility Bulletin No. 114.

2^15-1 — A 32,767-bit pseudorandom pattern which generates a maximum of 14 sequential zeros and 15 sequential ones. This pattern conforms to ITU-T Recommendation O.151.

1111 — An all marks (1) pattern and is available in all modes except MUXED M13 and MUXED C-BIT.

1100 (IDLE) — A repeating two marks (1) and two spaces (0) pattern which equates to sending the DS3 Idle Signal. It is only available in the M13 and C-BIT modes.

1100 — An unframed repeating two marks (1) and two spaces (0) pattern which is only available in the UNFRAMED mode.

1010 (BLUE) — An alternating marks (1) and spaces (0) pattern which equates to sending the DS3 Blue Signal. It is only available in the M13 and C-BIT modes.

1010 — An unframed alternating marks (1) and spaces (0) pattern which is only available in the UNFRAMED mode.

USER1 — A 3- to 24-bit user-programmable test pattern. This allows the T-BERD 310 to transmit specific patterns to test circuit sensitivity. The pattern is entered in binary form through the MISC-USER1 auxiliary function.

Channelized test patterns — These patterns are channelized, i.e., they contain embedded DS2 and DS1 framing. The following DS1 test patterns are available when either the MUXED M13 or MUXED C-BIT mode is selected. The test patterns are formatted with either D4 or ESF framing.

NOTE

These DS1 patterns are generated on the mainframe. Errors inserted from the DS1/DS0 Analyzer Option are not inserted on these DS1 patterns.

T1D4 QRSS — A modified 2^{20}-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The T1D4 QRSS pattern simulates live data for T1 applications.

T1D4 3/24 — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the D4 F-bits as indicated.

T1D4 1:7 — A fixed test pattern of F01000000.... The pattern is aligned with the D4 F-bits as indicated, to prevent false Yellow Alarms.

T1D4 1004Hz — A 1004 Hz tone which is transmitted over the selected DS1 channel. The tone is phase shifted between adjacent DS0 channels to prevent Yellow Alarms.

T1D4 LPUP — A loop-up code selected with the MUXED TX-DS1 LP CODE auxiliary function.

T1D4 LPDN — A loop-down code selected with the MUXED TX-DS1 LP CODE auxiliary function.

T1ESF QRSS — A modified 2^{20}-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The T1ESF QRSS pattern simulates live data for T1 applications.

T1ESF 3/24 — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the ESF F-bits as indicated.

T1ESF 1:7 — A fixed test pattern of F01000000....

T1ESF 1004Hz — A 1004 Hz tone which is transmitted over the selected DS1 channel.

T1ESF LPUP — A loop-up code selected with the MUXED TX-DS1 LP CODE auxiliary function.

T1ESF LPDN — A loop-down code selected with the MUXED TX-DS1 LP CODE auxiliary function.

DS1 INSERT mode — This mode is only available when the DS1 Insert/Secondary DS3 Receive Option is installed.

EXTERNAL DS1 — Selects the DS1 signal input from the side-panel DS1 INSERT INPUT connector.

INTERNAL DS1 — Selects the DS1 signal generated by the DS1/DS0 Analyzer Option.

2.2.6 DS3 TRANSMIT TIMING Switch [6]

The **DS3 TRANSMIT TIMING** switch selects the DS3 transmit clocking source for the T-BERD 310. The switch LEDs flash if the appropriate timing signal is not present. Press the **DS3 TRANSMIT TIMING** switch to select one of the following:

INT — The transmit timing source is generated by the internal crystal-controlled oscillator.

RECOVD — The transmit timing source is taken from the clock signal recovered from the received data. In the THRU and DS1 INSERT modes, the **DS3 TRANSMIT TIMING** switch automatically defaults to RECOVD regardless of the current setting. Recovered timing is used when the T-BERD 310 is monitoring a received signal.

EXT — The transmit timing source is taken from an external clock source received through the side-panel EXT CLOCK connector.

2.2.7 SONET TRANSMIT TIMING Switch [7]

A SONET transmit option must be installed for this switch to be operational. It allows the user to select a variety of timing sources for SONET testing. Refer to Section 2.30 for more information about this switch.

2.2.8 LASER ENABLE Switch [8]

A SONET transmit option must be installed for this switch to be operational. It controls laser transmitters for SONET testing. Refer to Section 2.30 for more information about this switch.

2.2.9 AUX Switch [9]

The **AUX** switch illuminates when the auxiliary functions are displayed. When the **AUX** switch is *not* illuminated, the mode, test pattern, and results are displayed. Auxiliary functions allow access to parameters that are not frequently used and do not have dedicated switches. The auxiliary functions are divided into auxiliary groups as listed in Table 2-2. Refer to Section 2.60 for detailed information on the auxiliary functions.

Table 2-2. T-BERD 310 Auxiliary Functions

Group (MODE Switch)	Function (PATTERN Switch)	Description
ERR INSERT DS3 Error Insertion Group	LOG/BPV RT	Logic and BPV Error Insertion Rate
	FRAME ERROR	M-Frame Error Insertion Rate
	LOG/BPV BUR	Logic and BPV Error Insertion Burst Duration
ERR RECEIVE DS3 Received Signal Error Group	PAR ERR RT	Parity Category Error Rate Calculation
	FRM LOSS THR	Frame Synchronization Loss Threshold
	ERROR THR	Logic, BPV, and Frame Errored Second Rate Threshold
	PAT LOSS THR	Pattern Loss Threshold
MUXED TX Multiplexed Loop Code Group	DS1 LP CODE	DS1 Loop Code Select
	PGM LPUP	Programmable Loop-Up Code
	PGM LPDN	Programmable Loop-Down Code
TIME Time and Date Group	SET TIME	Set Time
	SET DATE	Set Date
	TEST LENGTH	Set Test Length
	TEST	Set Test Duration Type
PRINT Printer/Remote Control Interface Group	INTERVAL	Timed Printout Interval
	MODE	Printout Mode
	FORMAT	Printout Format
	CUSTOM	Customized Printout Contents
	GRAPH	Print Pulse Shape Graph
	BAUD RATE	RS-232 Interface Baud Rate
	PARITY	RS-232 Interface Parity
	TERMINATOR	Printout Line Terminator
	WIDTH	Printout Line Width
	PORT	Printer/Remote Control Interface Port Selection (310-6 option)
	PRINT EVENT	Set Printout Event
	PRINT TYPE	Set Printout Type

Table 2-2. T-BERD 310 Auxiliary Functions (Continued)

Group (MODE Switch)	Function (PATTERN Switch)	Description
MISC Miscellaneous Group	USER1	User-Programmable Test Pattern
	DS1/VT MAP	DS1/VT Mapping Select
	TX X-BIT	X-Bit Transmission
	BLU SIG CRI	Blue Signal Detection Criteria
	DS1 LINECODE	DS1 Drop Output Line Coding
	BEEP CRI	Beep Criteria
	PULSE MASK	Pulse Shape Mask
	FEAC ALARMS	DS3 FEAC Alarm Control
	FEAC LOOP	DS3 FEAC Message Loopback Control
	LCD CONTRAST	Display Contrast Control (some 310-1 options)
	DS1 SIG BITS	DS1 Signaling Transfer Mode (310-13R/T pair or 310-14R/T pair option)
	DS1 BITS CLK	DS1 Building Integrated Timing Source (BITS) Clock Termination (310-13T or 310-14T option)
	DS3 LEVEL	Set DS3 Transmit and Receive Levels
SONET RX SONET RX Group (310-12, 310-13R, 310-14R, and 310-21 Options)	DS1 DROP OUT	DS1 Drop Output Source
	STS RX LEVEL	STS Receive Level
	SONET DCC	SONET Data Communication Channel Drop and Insert Control
	SECTION BIP	Section BIP Calculation Control
SONET TX SONET TX Group (310-12, 310-13T, 310-14T, and 310-21 Options)	STS TX LEVEL	STS Transmit Level
	SONET ERR RT	SONET Error Rate Select
	BIT ERR INS	SONET Payload Logic Error Insertion Rate Control
	SPE POINTER	Synchronous Payload Envelope Pointer Control
	PATH TRACE	Path Trace Message Insertion Control
	ORDERWIRE	Orderwire Channel Control
	TX WAVELEN	Dual Wavelength Transmitter Control (310-12-DUAL, 310-14T-DUAL, or 310-21-DUAL option)
ATM RX ATM RX Group (310-15, 310-17A, and 310-20 Options)	NETWORK I/F	Received ATM Network Interface Select
	TEST MASK	Received ATM Cell Test Mask Control
	PROFILE Pn/SRCH MASK	Received ATM Cell Test Profile Control (n = 1 to 4)
	PREVIEW	Received ATM Cell Test Profile Preview Select
	BW PERIOD	Received ATM Cell Test Profile Bandwidth Select
	RATE SELECT	ATM Rate Select (requires more than one ATM option)
	PROFILE BASE	Set Test Profile Programming Mode
SONET BYTES Manufacturing Software Group (310-18)	XX BYTE	XX can be A1, A2, F1, D1-D12, K1, K2, Z1, Z2, C2, G1, F2, Z3, Z4, Z5
	USER 1/USER 2 BYTE	Programable by User

Table 2-2. T-BERD 310 Auxiliary Functions (Continued)

Group (MODE Switch)	Function (PATTERN Switch)	Description
ATM TX ATM TX Group (310-15, 310-17A, and 310-20 Options)	NETWORK I/F	Transmitted ATM Network Interface Select
	PROFILE Pn	Transmitted ATM Cell Test Profile Control (n = 1 to 4)
	TEST PROFILE	Transmitted ATM Cell Test Profile Select
	CELL BNDWDTH	Transmitted ATM Cell Test Profile Bandwidth Select
	PEAK BNDWDTH	Transmitted ATM Cell Test Profile Peak Bandwidth Select
	PEAK DURATON	Transmitted ATM Cell Test Profile Peak Duration Select
	HEC ERR RATE	Transmitted ATM Header Error Control Error Rate
	HEC ERR INS	Transmitted ATM Header Error Control Error Insert Control
	OAM INSERT	Transmitted ATM OAM Insert Control
	OAM FLOW	Transmitted ATM OAM Flow Control (Continued)
	PLCP ERR RT	Transmitted ATM PLCP Error Rate Control (310-17 option only)
	PLCP ERR INS	Transmitted ATM PLCP Error Insert Control (310-17 option only)
	CORRELATION	Transmitted ATM Correlation Tag Control
OPTICAL TEST Optical Test Group (310-16 Option)	STABL SOURCE	Optical Stable Source Select
	RETURN LOSS	Return Loss Measurement Type
	OPTICAL PWR	Optical Power Measurement Control
JITTER DS3 Jitter Group (310-5 Option)	JIT FILTER	Jitter Bandpass Filter Select
	JIT SCALE	Jitter Amplitude Scale Select
	JIT THRSHOLD	DS3 Jitter Threshold Select
WDM RX WDM RX Group (310-22 Option)	WDM RX MODE	Optical DWDM Receive Scan or Drop Select
	WDM RX UNITS	Optical DWDM Receive Wavelength (nm) or Frequency (THz) Select
	WDM RX CHANNEL	Optical DWDM Receive Available Channel Select
	WDM RX PEAK	Optical DWDM Receive Peak Threshold or Peak Excursion Select

2.2.10 Channel Control Switch [10]

The **Channel Control** switch is used to specify the use of the **Channel Control-INSERT** and **Channel Control-DROP** switches as follows:

DS3-DS1 — The **INSERT** and **DROP** switches select the DS1 to be dropped and inserted through the primary DS3 signal. The switch defaults to this position when SONET options are not installed.

SONET-VT — The **INSERT** and **DROP** switches select the VT to be dropped and inserted through the SONET signal. A SONET option must be installed to active this selection. Refer to Section 2.30 for more information about the switch.

SONET-STS — The **INSERT** and **DROP** switches select the STS-1 to be dropped and inserted through the SONET signal. A SONET option must be installed to active this selection. Refer to Section 2.30 for more information about the switch.

2.2.11 DS3-DS1 Channel Control-INSERT Switch [11]

This section describes the **Channel Control-INSERT** switch when the **Channel Control** switch is set to **DS3-DS1**. For more information on the **SONET-VT** or **SONET-STS** selections, refer to Section 2.30.

The **DS3-DS1 Channel Control-INSERT** switch selects the DS1 channel to be inserted into the primary DS3 signal. The switch selection is available in either MUXED M13, MUXED C-BIT, or DS1 INSERT modes. Either a D4 or ESF framed test pattern, 1004 Hz tone, or DS1 loop codes can be inserted into the selected channel. When the **DS3-DS1 Channel Control-INSERT** switch is pressed, the channel number flashes for 3 seconds before the new selection takes affect. This allows time to change the selection without affecting a DS1 channel unintentionally. The **DS3-DS1 Channel Control-INSERT** switch selections include:

1 to 28 — Inserts the test pattern on the selected DS1 channel. A framed All Ones pattern is inserted on the other 27 DS1 channels.

ALL — Inserts the selected test pattern on all 28 DS1 channels.

— — — (none) — Inserts a framed All Ones pattern on all 28 DS1 channels.

When the DS1 INSERT mode is selected, the **DS3-DS1 Channel Control-INSERT** switch functions differently. In some instances the **DS3-DS1 Channel Control-INSERT** switch window can appear blank or display three bars (— — —) depending on the selected mode, in which case the **DS3-DS1 Channel Control-DROP** switch can select a channel being inserted.

NOTE

In MUXED M13 or MUXED C-BIT mode the DS1 pattern is generated by the mainframe, not the DS1/DS0 Analyzer Option. Errors inserted from the option are not inserted in the DS3 signal.

2.2.12 DS3-DS1 Channel Control-DROP Switch [12]

This section describes the **Channel Control-DROP** switch when the **Channel Control** switch is set to **DS3-DS1**. For more information on the **SONET-VT** or **SONET-STS** selections, refer to Section 2.30.

The **DS3-DS1 Channel Control-DROP** switch selects the DS1 channel to be dropped from the primary DS3 signal. The switch selection is available in either MUXED M13, MUXED C-BIT, or DS1 INSERT modes. The selected DS1 channel number (1 to 28) appears in the window above the switch.

When the AIS indication is detected on the dropped DS1 channel, three decimal points appear in the **Channel Control-DROP** switch display.

The DS1 channel (1 to 28) can be dropped to the DS1/DS0 Analyzer Option. If a SONET option is installed, a DS1 channel can be dropped from a SONET DS3 or DS1 payload. E1 channels (E1 to E21) can be dropped to the E1 DROP connector.

The DS1 channel can also be dropped from the DS3 RECEIVE connector to the side-panel DS1 DROP connector. The DS1 DROP connector allows an external DS1 test set to be connected to the T-BERD 310

2.3 TEST CONNECTIONS

The T-BERD 310 provides a number of connections and switches used to access the circuit being tested. The primary DS3 signal connections are provided on the front panel as shown in Figure 2-3. The side panel contains standard and optional connections. The standard side-panel connections are described in this section; the optional connections are described in the individual option sections.

The DS3 WECO 560A connectors can be replaced with BNC connectors when the factory-installed 310-8A BNC Connector Option is ordered.

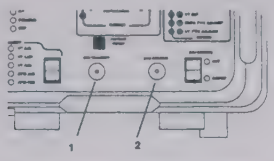


Figure 2-3. DS3 Front-Panel Connections

2.3.1 Front-Panel Connections

The following front-panel connections are used to receive and source a DS3 signal (see Figure 2-3).

DS3 RECEIVE connector [1] — This WECO 560A connector is used to receive the DS3 signal from the circuit under test. The input signal equalization is controlled by the MISC-DS3 LEVEL auxiliary function.

DS3 TRANSMIT connectorconnector [2] — This WECO 560A connector is used to transmit a DS3 signal from the T-BERD 310 to the circuit under test. The output level is controlled by the MISC-DS3 LEVEL auxiliary function.

2.3.2 Side-Panel Connections

Depending on the configuration of the T-BERD 310, the side panel provides a number of standard and optional connections. The standard side-panel connections (see Figure 2-4) include the following:

RS-232 Interface connector [1] — This RS-232-C, 25-pin D connector is configured as DCE. It is used to connect the T-BERD 310 to a serial printer, dumb terminal, computer, or other asynchronous communications device. The PRINT auxiliary group controls the baud rate, parity, and line terminator of the connector. The connector pin assignments are described in Table 4-1.

MULTIPLE DS3 OUTPUT connectors [2] — These WECO 560A connectors provide five additional DS3 signal outputs and follow the DS3 TRANSMIT connector signal.

DS1 DROP connector [3] — This Bantam (new units) or WECO 310 (old units) connector enables the selected DS1 channel (**DS3-DS1 Channel Control-DROP** switch) to be dropped to an external DS1 test set. The MISC-DS1 LINECODE auxiliary function controls the output signal coding (AMI or B8ZS). If a SONET option is installed, refer to Section 2.30.

EXT CLOCK connector [4] — This BNC connector enables an external DS3 clock source to be input to the T-BERD 310 as the DS3 transmit clock. The clock source is selected when the **DS3 TRANSMIT TIMING** switch is set to EXT.

BIT ERR PULSE Connector [5] — This BNC connector provides the output for the bit error pulse feature. When the test set detects a bit error in the DS3 signal, a pulse is sent to this BNC connector.

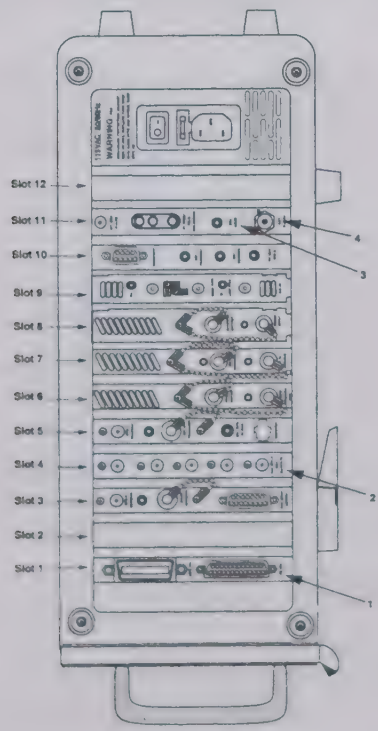


Figure 2-4. Possible T-BERD 310 Side-Panel Option Connections

The optional connections are described in the appropriate sections.

2.4 SIGNAL VERIFICATION

The following indicators and results verify the T-BERD 310 has properly acquired the received DS3 signal (see Figure 2-5).

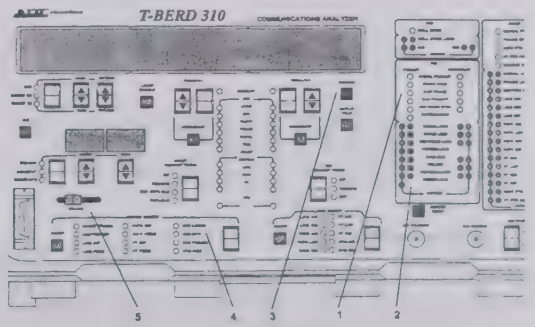


Figure 2-5. DS3 Controls and Indicators for Testing

2.4.1 DS3 Status LEDs [1]

NOTE

This section describes the DS3 Status LEDs only. For descriptions of SONET and ATM LEDs, refer to Section 2.33 and Section 2.39 respectively

For DS3 signal testing, green Status LEDs provide information about the current condition of the received primary and secondary (optional) DS3 signals. The DS3 Status LEDs are divided into two groups, PRIMARY and SECONDARY. The Primary Status LEDs refer to the signal received through the DS3 RECEIVE connector. The Primary Status LEDs also indicate the condition of the DS3 signal dropped from a SONET DS3 payload. The Secondary Status LEDs refer to the DS3 signal received through the SECONDARY DS3 RECEIVE connector when the DS1 Insert/Secondary DS3 Receive Option is installed. The DS3 Status LEDs are described as follows.

Signal Present — Illuminates when the T-BERD 310 detects multiple DS3 pulses. If the received signal is lost, the LED goes out and the Signal Loss LED illuminates.

Frame Sync — Illuminates when the T-BERD 310 acquires M13 or C-bit frame synchronization. If the received framing format is lost, the LED goes out and the Frame Loss LED illuminates.

C-Bit Frame — Illuminates when the T-BERD 310 acquires C-bit frame synchronization.

Idle Present — Illuminates when the T-BERD 310 detects a DS3 Idle Signal.

DS2 Frame Sync — Illuminates when the T-BERD 310 synchronizes to the DS2 framing format corresponding to the dropped DS1 channel. The T-BERD 310 must be synchronized with the DS2 framing format before a DS1 signal can be inserted. If the received DS2 framing format is lost, the LED goes out and the DS2 Frame Loss LED illuminates.

Pattern Sync — Illuminates when the T-BERD 310 synchronizes to the test pattern displayed in the PATTERN window. If pattern synchronization is lost, the LED goes out and the Pattern Loss LED illuminates.

2.4.2 DS3 Alarm LEDs [2]

NOTE

This section describes the DS3 Alarm LEDs only. For descriptions of SONET and ATM LEDs, refer to Section 2.30 and Section 2.36 respectively.

For DS3 signal testing, red Alarm LEDs provide information about the current and historical alarm conditions related to the received primary and secondary (optional) DS3 signals. The DS3 Alarm LEDs are divided into two groups, PRIMARY and SECONDARY with two columns for current and history conditions (see Figure 2-5).

The Primary Alarm LEDs refer to the signal received through the DS3 RECEIVE connector. The Primary Alarm LEDs also indicate the condition of the DS3 signal dropped from a SONET DS3 payload. The Secondary Alarm LEDs refer to the signal received through the SECONDARY DS3 RECEIVE connector when the DS1 Insert/Secondary DS3 Receive Option is installed.

Alarm LEDs (inside columns) illuminate when an alarm condition occurs and remain illuminated as long as the alarm exists. When the alarm condition is cleared, the Alarm LED goes out and the associated History LED (outside columns) illuminates. History LEDs indicate past occurrences of the alarm and remain illuminated until either the **HISTORY RESET** switch is pressed or a test restart is initiated. The Primary Alarm LEDs are described as follows:

Signal Loss — Illuminates when DS3 pulses are no longer detected after initial signal detection. When the DS3 pulses are detected again, the LED goes out, and the associated History LED and the Signal Present LED illuminate.

Frame Loss — Illuminates when the T-BERD 310 loses DS3 frame synchronization. When DS3 framing is detected again, the LED goes out, and the associated History LED and the Frame Sync LED illuminate. The ERR RECEIVE-FRM LOSS THR auxiliary function sets the frame loss criteria.

DS2 Frame Loss — Illuminates when the T-BERD 310 loses frame synchronization to the DS2 signal for the corresponding dropped DS1 channel. When DS2 framing is detected again, the LED goes out, and the associated History LED and the DS2 Frame Sync LED illuminate.

Pattern Loss — Illuminates when the T-BERD 310 loses DS3 pattern synchronization. When the pattern is resynchronized again, the LED goes out, and the associated History LED and the Pattern Sync LED illuminate. The ERR RECEIVE-PAT LOSS THR auxiliary function sets the pattern loss criteria.

Blue (AIS) — Illuminates when the T-BERD 310 detects the Blue Signal (Alarm Indication Signal). When the Blue Signal is no longer detected, the LED goes out and the associated History LED illuminates. The MISC-BLU SIG CRI auxiliary function sets Blue Signal detection criteria.

Yellow — Illuminates when the T-BERD 310 detects the Yellow Alarm or Far-End Out-of-Frame (FEOOF) signal (X-bits set to zero). When the Yellow Alarm is no longer detected, the LED goes out and the associated History LED illuminates.

Far-End Alarm — Illuminates when the T-BERD 310 detects Far-End Alarm and Control (FEAC) messages in the C-bit parity framing format (third C-bit in the M1 subframe). When the far-end alarm is no longer detected, the LED goes out and the associated History LED illuminates. The alarm messages are reported in the SUMMARY category. Refer to Table 2-8 for a list of far-end alarm messages.

Power Loss — Illuminates when the T-BERD 310 regains power after power was lost.

HISTORY RESET switch — This switch clears all History LEDs on the T-BERD 310. This switch does not restart a test, nor does it affect any of the Alarm LEDs or accumulated results. It is not operable when the **DISPLAY HOLD** switch is activated. The **RESTART** switch also clears the History LEDs.

2.4.3 SUMMARY Category Messages

The SUMMARY category provides a convenient way to monitor specific results and measurements without having to search through the other categories. The SUMMARY category also provides a number of messages indicating whether the results are in or out of specification. The SUMMARY category is selected by pressing either the **RESULTS I Category** switch or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

During initial acquisition of the received signal, the SUMMARY category should be displayed. The following messages can appear during signal acquisition:

ALL RESULTS UNAVAILABLE — This indicates that the T-BERD 310 has not detected the received signal.

ALL RESULTS OK — This indicates that the T-BERD 310 has detected and synchronized to the received signal and that no key results are non-zero or out-of-specification.

When an error is detected, the appropriate test result appears in the SUMMARY category window. Refer to Section 2.89 for more information on the results that appear in the SUMMARY category.

2.5 STARTING AND RUNNING THE TEST

The following controls, indicators, and results are used to start and perform a test (see Figure 2-5).

2.5.1 RESTART Switch [3]

Pressing the **RESTART** switch halts the current test, clears all results, clears the Status and Alarm LEDs, resynchronizes the receiver to the received signal, and restarts the test.

NOTE

Pressing one of the following switches also causes a test restart of the T-BERD 310: **MODE, PATTERN, DS3 SOURCE,** and **Power.** Modifying one of the following auxiliary functions causes a test restart: ERR RECEIVE-PAR ERR RT, ERR RECEIVE-FRM LOSS THR, ERR RECEIVE-ERROR THR, ERR RECEIVE-PAT LOS THR, TIME-TEST LENGTH, MISC DS3 LEVEL (receive side), MISC-USER1, and MISC-PULSE MASK.

2.5.2 Error Insertion (DS3 Logic, DS3 BPV, DS3 Frame) [4]

After the T-BERD 310 has synchronized to the received signal, in-service monitoring and analysis can be performed without additional setup requirements. However, if the circuit being tested is configured for an out-of-service loopback or end-to-end test, you may need to verify that the transmitted signal is being received. One way to verify this is to insert an error into the transmitted signal and verify the error is received. DS3 errors are inserted into the data stream one type at a time. Error insertion affects the transmitted signal at the DS3 TRANSMIT and MULTIPLE DS3 OUTPUT connectors.

Press the **ERROR INSERT Selection** switch (see Figure 2-5) to select the desired error type; the LED illuminates, then perform the appropriate actions as described below. To stop error insertion, press the **INSERT** switch again. (Scrolling the **ERROR INSERT Selection** switch to another selection also halts error insertion.)

2.5.2.1 Inserting DS3 Logic Errors

Select DS3 LOGIC to insert single, burst, or continuous logic errors into the transmitted DS3 data and overhead bits. When DS3 LOGIC is selected and the **INSERT** switch is pressed the associated LED illuminates, indicating errors are being inserted. Duration and error rate are affected by the way the **INSERT** switch is pressed, as described below, and by setting an appropriate auxiliary function as follows:

Single and Burst Errors — Set the ERR INSERT-LOG/BPV BUR auxiliary function to insert a single error, or to set a burst duration of from 25 ms to 5 seconds. Press the **INSERT** switch for less than 1 second to insert a single error or a burst of errors.

Continuous Errors — Set the ERR INSERT-LOG/BPV RT auxiliary function for a continuous error rate from 1E-2 to 1E-9. Press the **INSERT** switch for more than 1 second to insert continuous errors.

When the T-BERD 310 is in MUXED M13 or MUXED C-BIT mode, the **INSERT** switch inserts single logic errors into the selected DS1 channel. If the **DS3-DS1 Channel Control-INSERT** switch is set to "--- --- ---" (none), no error is inserted when the **INSERT** switch is used. If the **DS3-DS1 Channel Control-INSERT** switch is set to **ALL**, a single logic error is inserted into all 28 channels simultaneously. Single DS3 errors

are no longer present in the DS3 signal since the DS1 error occurs before multiplexing to the higher rate. The rate and burst features of the **INSERT** switch continue to simulate random signal degradation across the entire DS3 signal.

2.5.2.2 Inserting DS3 BPVs

Select DS3 BPV to insert single, burst, or continuous BPVs into the transmitted DS3 signal. When the DS3 BPV is selected and the **INSERT** switch is pressed the associated LED illuminates, indicating violations are being inserted. Duration and error rate are affected by the way the **INSERT** switch is pressed, as described below, and by setting an appropriate auxiliary function as follows:

Single and Burst Errors — Set the ERR INSERT-LOG/BPV BUR auxiliary function to insert a single error, or to set a burst duration of from 25 ms to 5 seconds. Press the **INSERT** switch for less than 1 second to insert a single error or a burst of errors.

Continuous Errors — Set the ERR INSERT-LOG/BPV RT auxiliary function for a continuous error rate from 1E-2 to 1E-9. Press the **INSERT** switch for more than 1 second to insert continuous errors.

2.5.2.3 Inserting DS3 Frame Errors

Select DS3 FRAME to insert single, multiple, or continuous consecutive M-frame errors into the transmitted DS3 framing bits. The DS3 FRAME is disabled in the UNFRAMED, THRU, AUTO (with *live* pattern displayed), and DS1 INSERT (DS1 Insert/Secondary DS3 Receive Option installed) modes. When DS3 FRAME is used the associated LED illuminates, indicating errors are being inserted. Duration is affected by the way the **INSERT** switch is pressed as described below, and by setting the ERR INSERT-FRAME ERROR auxiliary function as follows:

Single Frame Error — Set the auxiliary function to 1/M-FRAME (one frame error per M-frame). Press the **INSERT** switch for less than 1 second to inject a single frame error.

Multiple Frame Errors — Set the auxiliary function to 2/M-FRAME (two consecutive frame errors per M-frame). Press the **INSERT** switch for less than 1 second to inject two consecutive frame errors.

Continuous Consecutive Frame Errors — Set the auxiliary function to either 1/M-FRAME or 2/M-FRAME. Press the **INSERT** switch for more than 1 second to inject continuous frame errors.

In DS3 THRU MODE only DS3 LOGIC and DS3 BPV errors can be inserted. The DS3 Frame error selection can be scrolled to, but the **INSERT** switch is not functional.

2.5.2.4 Inserting SONET Errors

The SONET transmit option must be installed for the SONET LEDs to function. For a description of SONET error insertion, refer to Section 2.30.

2.5.2.5 Inserting ATM HEC Errors

The ATM HEC error insert is set up in the HEC ERR RATE and HEC ERR INS auxiliary functions. For a description of ATM HEC error insert, refer to Section 2.36.

2.5.3 VOLUME Switch [6]

The **VOLUME** control switch (see Figure 2-5) controls the output of the built-in speaker. The T-BERD 310 beeps whenever conditions set by the MISC-BEEP CRI auxiliary function are met. If the DS1/DS0 Analyzer Option is installed, the **VOLUME** switch also controls the DS0 channel volume of the speaker.

2.6 COLLECTING TEST RESULTS

This section describes the available test result categories and controls used to collect the test results (see Figure 2-6).

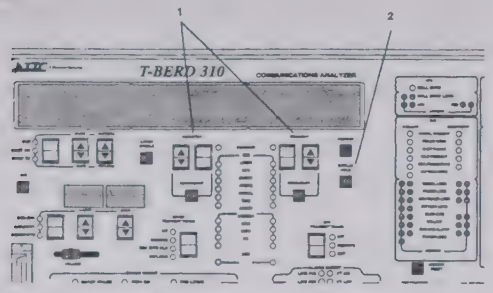


Figure 2-6. Collecting DS3 Test Results

2.6.1 Categorized Test Results

During a test, the available results and signal measurements are continuously updated. The results are divided into six DS3 categories, four SONET categories, and one ATM category. The first and most commonly used category is the SUMMARY category. During the initial test setup procedure, the SUMMARY category displays key non-zero or out-of-specification results. Refer to Section 2.89 for more information on the test results. The available categories include:

SUMMARY category — Lists key results that are non-zero or out-of-specification.
DS3 LOGIC category — Lists DS3 pattern bit error related results.
DS3 BPV category — Lists DS3 bipolar violation related results.
DS3 PARITY category — Lists DS3 P-bit, C-bit, FEBE, and parity error related results.
DS3 FRAME category — Lists DS3 and DS2 frame error related results.
DS3 SIGNAL category — Lists DS3 signal (frequency, level, and pulse shape) related results.
DS3 TIME category — Lists time-related results.
SONET SECTION category — Lists SONET Section overhead test results. Refer to Table 2-21 for more information on the test results.

SONET LINE category — Lists SONET Line overhead test results. Refer to Table 2-22 for more information on the test results.
SONET PATH category — Lists SONET Path overhead test results. Refer to Table 2-25 for more information on the test results.
SONET VT category — Lists SONET virtual tributary overhead test results. Refer to Table 2-27 for more information on the test results.
ATM category — Lists ATM test results (Requires 310-15 option). Refer to Table 2-28 for more information on the test results.

2.6.2 RESULTS Switches and Windows [1]

When the mode and pattern are displayed, two results appear simultaneously in the RESULTS I and RESULTS II windows (see Figure 2-6). The available categories and results are selected with the following switches.

RESULTS I Category switch or RESULTS II Category switch — Selects the category from the list of categories next to the switch. The labeled LEDs illuminate as the category is selected. Categories are skipped when they do not apply to a particular operating mode.

RESULTS I Results switch or RESULTS II Results switch — Selects the individual results from the indicated category.

RESULTS I SECONDARY switch or RESULTS II SECONDARY switch — Selects the results from the secondary DS3 signal when the DS1 Insert/Secondary DS3 Receive Option is installed. The SUMMARY, BPV, PARITY, FRAME, and SIGNAL categories are the only categories available when the **SECONDARY** switch is pressed. The associated LED illuminates when the secondary DS3 results are displayed. Use the **RESULTS** switches to select the secondary DS3 results.

2.6.3 DISPLAY HOLD Switch [2]

Pressing the **DISPLAY HOLD** switch (switch illuminates) temporarily freezes the results and Status and Alarm LEDs (see Figure 2-6). During the display hold, all results can be examined by using the **RESULTS** switches. The results also continue to accumulate in the background. When the **DISPLAY HOLD** switch is released, the results and LEDs are updated.

NOTE

There is an additional functionality to the DISPLAY HOLD Switch. When in remote control mode, the DISPLAY HOLD key allows the user to return to local mode. When pressed, the key blinks, indicating the action has taken place

E1 DROP

2.7 INTRODUCTION

E1 Drop enables the T-BERD 310 to drop an E1 channel from a DS3 signal to an external test set such as the TTC INTERCEPTOR 1402S Communications Analyzer. E1 Drop adds an E1 Drop output connection on the T-BERD 310 side panel. Unless otherwise indicated in this section, the T-BERD 310 functions as previously described.

2.8 INITIAL TEST SETUP

The following controls and indicators are used to initially configure the T-BERD 310 to test DS3 signals and drop out an E1 channel. Refer to Figure 2-2.

2.8.1 SETUP Switch [2]

Set the **SETUP** switch to DS3 for E1 drop testing.

2.8.2 MODE/RATE Switch [4]

Select either the M13, C-BIT, AUTO, or THRU mode to drop an E1 signal. The received DS3 signal must have the proper DS2 Frame Alignment Sequence (DS2 FAS) to drop the E1 channel. The T-BERD 310 automatically senses the DS2 FAS.

2.8.3 DS3-DS1 Channel Control-DROP Switch [12]

When a DS3 signal is received, the **DS3-DS1 Channel Control-DROP** switch can select either a DS1 or an E1 channel. The selected DS1 channel is dropped to the side-panel DS1 DROP connector and the selected E1 channel is dropped to the side-panel E1 DROP connector. The E1 channel number (E1 to E21) is displayed in the DS3-DS1 Channel Control-DROP window.

Table 2-3 shows how the DS1 and E1 channels are grouped by DS2 M-frames. As the DS1/E1 channel is selected from one DS2 M-frame to another, the T-BERD 310 automatically synchronizes to the appropriate DS2 framing pattern. The message *DS2 TEST RESTART* also appears in the MODE/PATTERN window when changing from one DS2 M-frame to another.

If the DS3 signal contains both DS1 and E1 channels, the DS1 channels are displayed as "1" through "28" and the E1 channels are displayed as "E1" to "E21". When changing from one DS2 M-frame to another with alternating DS1 and E1 channels (by M-frame), the T-BERD 310 automatically senses the appropriate DS2 framing format and changes the channel number accordingly. For example, if the first DS2 M-frame has DS1 channels (1 to 4) and the second DS2 M-frame has E1 channels (E4 to E6), changing from DS1 channel 4 to 5 (see Table 2-3), would actually change the displayed channel from DS1 channel 4 to E1 channel E4.

Table 2-3. DS1 and E1 Channel Numbers

DS2 M-frames	DS1 Channel	E1 Channel
1	1	E1
	2	E2
	3	E3
	4	
2	5	E4
	6	E5
	7	E6
	8	
3	9	E7
	10	E8
	11	E9
	12	
4	13	E10
	14	E11
	15	E12
	16	
5	17	E13
	18	E14
	19	E15
	20	
6	21	E16
	22	E17
	23	E18
	24	
7	25	E19
	26	E20
	27	E21
	28	

2.9 TEST CONNECTIONS

E1 Drop can be accessed via a 3-pin banana connector on the side-panel DS1 DROP/EXT CLOCK slot (see Figure 2-7). The DS3 RECEIVE connector provides the only input signal to drop an E1 signal. If a SONET is installed, an E1 channel can be dropped from a SONET DS3 payload.

E1 DROP — 3-pin banana connector (120 Ω balanced) provides E1 signal output for an external test set, such as the TTC INTERCEPTOR 1402S Communications Analyzer.

Figure 2-7. E1 Drop Connection

2.10 SIGNAL VERIFICATION

The following indicators and results are used to verify that the T-BERD 310 has properly acquired the received DS3 signal and dropped the E1 channel. Refer to Figure 2-5.

2.10.1 DS3 Primary Status LEDs [1]

The DS3 Primary Status LEDs perform the same functions as previously described in this section with the exception of the DS2 Frame Sync LED. The DS2 Frame Sync LED also illuminates when a valid DS2 FAS is detected.

2.10.2 DS3 Primary Alarm LEDs [2]

The DS3 Primary Alarm LEDs perform the same functions as previously described in this section with the exception of the DS2 Frame Loss LED. The DS2 Frame Loss LED illuminates when the DS2 FAS is lost. When DS2 framing is detected again, the LED goes out, and the associated DS3 History LED and the DS2 Frame Sync LED illuminate.

2.10.3 SUMMARY Category Test Results and Messages

The SUMMARY category performs the same functions as previously described in this section for the DS3 signal analysis. During the initial acquisition of the received signal, the SUMMARY category should be displayed. This provides you with key results on the received DS3 signal when an error does occur.

2.10.4 DS3-DS1 Channel Control-DROP Window

When the T-BERD 310 is synchronized to the DS2 FAS (DS3/DS2 Frame Sync LED illuminated), an "E" appears in front of the E1 channel number (E1 to E21). When the T-BERD 310 is synchronized to the DS2 framing (DS3 DS2 Frame Sync LED illuminated), the DS1 channel number appears (1 to 28).

2.11 COLLECTING TEST RESULTS

The E1 signal test results and measurements must be made through an external test set, such as the TTC INTERCEPTOR 1402S Communications Analyzer. The DS3 signal test results should be checked to verify that the DS3 signal is functioning properly. When a DS3 signal is received with embedded E1 channels, the DS2 FRM ERR, DS2 FRM ERT, and DS2 AV F ERT results indicate DS2 FAS errors, not DS2 frame errors.

DS1/DS0 ANALYZER OPTION (310-1)

2.12 INTRODUCTION

The 310-1 DS1/DS0 Analyzer Option attaches to the T-BERD 310 Communications Analyzer to provide DS1 and DS0 test and analysis capabilities from DS3, DS1, and SONET (with a SONET option installed) access points.

The DS1/DS0 Analyzer Option replaces the standard T-BERD 310 cover. An extension cable connects the DS1/DS0 Analyzer Option to the T-BERD 310 for power and communications. This connection is made through the DS1/DS0 Analyzer Option port. DS1, ESF and SLC datalink, DS0, and VF signal connections for the DS1/DS0 Analyzer Option are provided through the T-BERD 310 side panel.

Appendix B shows the functional block diagram of the T-BERD 310 mainframe and the DS1/DS0 Analyzer Option.

2.12.1 Features and Capabilities

The DS1/DS0 Analyzer Option is designed to test and analyze T-Carrier transmission systems at the DS1 and DS0 levels from DS3 or DS1 access points. The DS1/DS0 Analyzer Option provides the following features and capabilities:

Analyzes a DS1 channel dropped from a DS3, DS1, or SONET access point for out-of-service testing and in-service monitoring.

Generates DS1 test patterns (QRSS, 3 IN 24, 1:1, 1:7, ALL ONES, 2^{23}-1, 2^{20}-1, 2^{15}-1, and programmable) with the appropriate DS1 framing requirements.

Operates in T1 unframed and framed modes which includes: T1 D4, T1 ESF, and SLC-96.

Auto configure mode enables the DS1/DS0 Analyzer Option to scan the received signal and configure itself to the signal framing and pattern.

Displayed results provide simultaneously accumulated logic, BPV, CRC, and frame error counts; error rates, errored seconds, and percent of error-free seconds results; pattern slips, received frequency measurement, and D4, ESF, and SLC signaling status.

Monitors for T1 pulses, pattern and frame synchronization, and reports them as successful events on the front panel.

Monitors for signal, pattern, and frame losses and reports them as current and historical alarm events on the front panel.

Scans all DS1 channels within a DS3 or SONET signal for framing errors, CRC errors, timing slips, and alarms. DS1 scanning can be performed in a continuous or triggered mode.

Monitors for Excess Zeros, Yellow Alarms, and All Ones conditions and reports them on the front panel.

Logic error and BPV insertion can be done as a single error or continuously at a rate of 10^{-3} to stress circuits or verify signal continuity between the transmitted and received signals.

Transmit timing control is provided through a front-panel switch for internal or recovered clock source.

T1 DSX-level output allows the DS1/DS0 Analyzer Option to be connected to a DS1 access point and transmit DS1 formatted test patterns.

T1 input accepts the DS1 signal from DS1 DSX access points.

Selects individual DS0 channels allowing data bits and D4, ESF, optional ESPz, and SLC signaling bits (A, B, C, and D) to be monitored.

A speaker and VF output connector (with fixed output) provide audible VF outputs for the selected DS0 channel.

Fixed and programmable loop codes provide remote loopback capabilities from a single site.

A dataport interface provides access to DS0 channels and the ESF, optional ESFz, and SLC datalinks.

Operates with AMI and B8ZS encoded data.

2.12.2 Options and Accessories

The following options and accessories are available for the DS1/DS0 Analyzer Option.

- 310-9B Enhanced DS1 Testing Option includes the ESF out-of-band loop codes, ESF PRM transmit and receive functions, and DS1 timing slips measurement. It also adds long user pattern (LUP) test patterns, Fractional-T1 (FT1) testing, and ESF synchronization message test result to the SIGNAL category.
- 310-10 G.821 Results Option adds the ITU-T G.821 performance analysis results to the T-BERD 310 and DS1/DS0 Analyzer Option LOGIC categories. The G.821 results include available seconds, % available seconds, % severely errored seconds, degraded minutes, % degraded minutes, and unavailable seconds.
- 19" Rack Mount, 41855-01.
- 23" Rack Mount, 41855-02.

2.13 INITIAL TEST SETUP

The following controls and indicators (see Figure 2-8) are used to initially configure the T-BERD 310/310-1 to test a circuit from a DS1 access point. The controls and indicators are described in the order that you would normally use them.

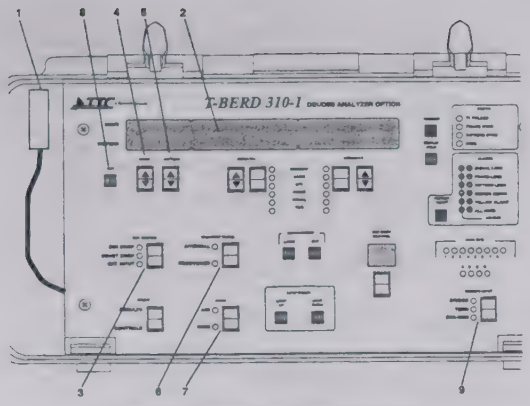


Figure 2-8. DS1/DS0 Analyzer Option front panel

2.13.1 Power [1]

Power is supplied through the DS1/DS0 Analyzer Option port connector and the T-BERD 310 AC power connection. During power-up, the DS1/DS0 Analyzer Option performs a self-test on itself and the interface with the T-BERD 310.

2.13.2 Front-Panel Display [2]

The display is divided into three windows: MODE/PATTERN, RESULTS I, and RESULTS II. The MODE/PATTERN window indicates the operating mode and test pattern of the DS1/DS0 Analyzer Option. The RESULTS I and RESULTS II windows indicate the results of the DS1/DS0 Analyzer Option. Adjust the DS1/DS0 Analyzer Option LCD viewing angle through the T-BERD 310 MISC-LCD CONTRAST auxiliary function.

2.13.3 DS1 SOURCE Switch [3]

The **DS1 SOURCE** switch selects the DS1 input source for the DS1/DS0 Analyzer Option. Press the **DS1 SOURCE** switch to select one of the following:

DS3 DROP — The DS1 signal is provided internally from the T-BERD 310 and selected with the **Channel Control-DROP** switch with DS3-DS1 selected. Verify that the mainframe indicates DS2 Frame Sync before attempting to analyze the DS1 payload.

SONET DROP — With SONET-VT selected (**Channel Control** switch), the **Channel Control-DROP** switch selects the DS1 dropped from the detected SONET signal. Verify the PATTERN window auto's to a DS1 payload when the **SETUP** switch is set to SONET RX before attempting to analyze a DS1 payload.

EXT. INPUT — The DS1 signal is provided directly from the side-panel DS1 RECEIVE connector.

2.13.4 MODE Switch [4]

The **MODE** switch selects the transmit and receive framing format configuration for the DS1/DS0 Analyzer Option. Press the **MODE** switch to select one of the following modes:

T1 — Configures the DS1/DS0 Analyzer Option to transmit and receive unframed T1 signals.

T1 D4 — Configures the DS1/DS0 Analyzer Option to transmit and receive D4 framed T1 signals.

T1 ESF — Configures the DS1/DS0 Analyzer Option to transmit and receive extended superframe (ESF) T1 signals. With the 310-9B option installed, the ESF out-of-band loop codes are available, and the ESF PRM can be transmitted and received.

T1 SLC — Configures the DS1/DS0 Analyzer Option to transmit and receive Subscriber Loop Carrier (SLC) framed T1 signals.

AUTO — Configures the receiver to automatically scan and synchronize to the input signal framing and pattern information. This includes synchronization to DS1 ATM signals (if option 310-17A is installed). After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. When the framing format is recognized, the framing format name appears in lowercase characters in the MODE/PATTERN window. If *live* data is declared, the **TRANSMIT TIMING** switch defaults to RECOVD.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic and BPV errors can be inserted with the **ERROR INSERT** switches.
- Full DS1 logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but live data:

- The word *live* appears in the PATTERN window.

- The transmitter retransmits the received signal, including errors.
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches.
- Full DS1 BPV, CRC, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate LEDs illuminate.

SCAN — Automatically scans and analyzes all DS1 channels available within the signal indicated by the **DS1 SOURCE** switch. This mode allows users the ability to detect all framing and pattern configurations, including DS1 ATM signals (if option 310-17A is installed), of all channels to isolate circuit configuration problems. The SCAN mode can be configured as either CONTINUE or TRIGGER with the **PATTERN** switch as follows:

SCAN CONTINUE — The DS1/DS0 Analyzer Option continually cycles through the available DS1 channels, records the status of the channels, and presents the information in real time. In continuous DS1 scan mode, the 310-1:

- Cycles through all 28 DS1 channels from the source indicated by the **DS1 SOURCE** switch.
- Previews each channel in cycle 0 to determine the framing format before checking for the other conditions.
- Repeatedly monitors each channel for the established conditions for 15 seconds in the succeeding cycles.
- Displays scan cycle counts and the channel number in the RESULTS I window.
- Automatically sets the RESULTS II window to the SUMMARY category and displays the detected test pattern, framing, and any alarms or errors found. The test pattern (e.g., 2^23-1, live, zeros, etc.) and framing (esf = ESF or ESFz, d4 = D4, unf = unframed, and slc = SLC) appear in abbreviated lowercase characters on the first line of the window. The channel number also appears according to the dropped channel source, i.e., a SONET dropped DS1 channel appears as a VT group/channel, and a DS3 dropped DS1 channel appears as a channel number from 1 to 28. The display indicates the information as follows:

SCAN	CYCLES: 1	1-1 unf 2^23-1
CONTINUE	CHANNEL: 3-4	RESULTS OK

SCAN TRIGGER — Each channel is scanned for events which are selected in the AUX-SCAN TRIG auxiliary function. In the triggered DS1 scan mode, the 310-1:

- Cycles through all 28 DS1 channels from the source indicated by the **DS1 SOURCE** switch.
- Previews each channel in cycle 0 to determine the framing format before checking for the other conditions.
- Repeatedly monitors each channel for the events selected in the AUX-SCAN TRIG auxiliary function for 15 seconds in the succeeding scan cycles.
- Displays the scan cycle counts and channel number in the RESULTS I window.
- Identifies the scan progress in the RESULTS II window.

55 OCTET — A fixed unframed 55-octet pattern and a variant of the MIN/MAX repeater stress pattern. This pattern can be used to stress test repeater timing recovery and ALBO circuitry. The pattern consists of rapid transitions from high ones density octets to low ones density octets. When the pattern is frame aligned, it violates the maximum zeros and ones density criteria. The pattern should only be transmitted over the repeatered span and not the network.

2.13.6 TRANSMIT TIMING Switch [6]

The **TRANSMIT TIMING** switch selects the DS1 transmit clocking source for the transmitted DS1 signal. Changing this switch causes a DS1/DS0 Analyzer Option test restart. Press the **TRANSMIT TIMING** switch to select one of the following:

INTERNAL — The transmit timing is generated by the internal crystal-controlled oscillator.

RECOVERED — The transmit timing source is taken from the clock signal recovered from the received data. The LED flashes when no signal is present at the DS1 RECEIVE connector.

2.13.7 CODE Switch [7]

The **CODE** switch selects the transmitted DS1 signal coding. The **CODE** switch only affects the transmitted output at the side-panel DS1 TRANSMIT connector. B8ZS decoding is performed automatically on the received input and is independent of the switch position. When B8ZS coding is detected, the B8ZS LED illuminates. When AMI coding is selected and B8ZS coding is detected, the message *B8ZS DETECTED* appears in the SUMMARY category and the B8ZS LED illuminates. When the optional T1 ESFz mode is selected, the **CODE** switch is disabled. Press the **CODE** switch to select:

AMI — Alternate Mark Inversion line coding.
B8ZS — Bipolar with 8-Zero Substitution encoding.

2.13.8 AUX Switch [8]

The **AUX** switch provides access to a number of auxiliary functions which have limited use during normal testing. Refer to Section 2.75 for more detailed information on the auxiliary functions.

2.14 TEST CONNECTIONS

The DS1/DS0 Analyzer Option can receive and analyze a DS1 signal from DS1, DS3, and SONET DS1 signal sources. The DS1/DS0 Analyzer Option also provides connections to drop DS0, VF, and datalink (ESF, optional ESFz, and SLC-96) signals.

2.14.1 [illegible]

Figure 2-9 describes the DS1/DS0 Analyzer Option side-panel connections.

DATAPORT connector — This 9-pin, female D connector provides access to the ESF, SLC-96, or ZBTSI datalinks and 64 or 56 kb/s DS0 channels. The DATAPORT is active only when frame synchronization is achieved. The AUX-DATAPORT auxiliary function controls the signal sent to the DATAPORT connector. Use the **MODE** switch to select the T1 ESF, optional T1 ESFx, or T1 SLC datalink. Use the **DS0 DROP CHANNEL** switch to select the DS0 channel. Refer to Table 4-3 for the DATAPORT connector pin assignments. A DATAPORT adaptor cable is available from TTC.

DS1 TRANSMIT connector — This Bantam (new units) or WECO 310 (old units) connector transmits DS1 signals with either AMI or B8ZS coding. The output signal format is controlled through the **MODE** switch.

DS1 RECEIVE connector — The side-panel Bantam (new units) or WBCO 310 (old units) connector accepts DS1 level signals. The **DS1 SOURCE** switch must be set to EXT. INPUT to select the DS1 RECEIVE connector. The receive input level is controlled by the **RECEIVE INPUT** switch.

VF OUT 600-OHM connector — The Bantam (new units) or WECO 310 (old units) connector provides a calibrated 0 dBm VF output across a 600-ohm termination. The output can also be heard from the speaker. The T-BERD 310 **VOLUME** switch only controls the speaker output. When frame synchronization is lost, the connector and speaker outputs are squelched.

Figure 2-9. DS1/DS0 Analyzer Option Connections

RECEIVE INPUT switch [9] (see Figure 2-8) — This switch selects the input level for the DS1 RECEIVE connector. Changing the switch position causes a test restart of the 310-1. The **RECEIVE INPUT** switch selections include:

BRIDGE — Provides an input impedance greater than 1000 ohms for bridging lines that are already terminated. The BRIDGE setting provides Automatic Line Build-out (ALBO) compensation for cable losses of up to 35 dB. This is useful for bridging directly across copper cable pairs.

TERM — Provides an input impedance of 100 ohms. The TERM setting provides ALBO compensation for cable losses of up to 35 dB. This is useful for terminating a circuit with the DS1/DS0 Analyzer Option.

DSX-MON — Provides both 100 ohms of input impedance and compensation for resistive loss. DSX-MON is useful for monitoring T1 lines at DSX-monitor points which are resistor-isolated. When cable compensation is not desired, the line can be terminated with this selection.

2.14.2 Dropping DS1 Channel from DS3 Signal

DS3 RECEIVE connector (see Figure 2-3) — The DS1 channel can be dropped from the DS3 RECEIVE connector. To drop the DS1 signal from the DS3 RECEIVE connector, set the following switches:

DS3 SOURCE switch (310) — Set to EXT.

DS1 SOURCE switch (310-1) — Set to DS3 DROP.

Channel Control switch (310) — Set to DS3-DS1.

Channel Control-DROP switch (310) — Select the desired DS1 channel from the DS3 signal.

2.14.3 Dropping DS1 Channel from SONET DS3 Payload

STS-1 RECEIVE connector or OC-1/3/12/48 RECEIVE connector — When a SONET option is installed, the DS1 channel can be dropped from a SONET DS3 payload received through the side-panel STS-1, OC-1, OC-3, OC-12, or OC-48 RECEIVE connector. To drop a DS1 channel from a SONET DS3 payload, set the following switches:

DS3 SOURCE switch (310) — Set to SONET.

DS1 SOURCE switch (310-1) — Set to DS3 DROP.

Channel Control switch (310) — Set to SONET-STS to select the correct STS identifier.

Channel Control-DROP switch: DS3-DS1 (310) — Select the desired DS1 channel from the SONET DS3 payload.

NOTE

The SONET AUTO mode can be used to easily identify a DS1 payload from a DS3 payload. Configure the **SETUP** switch for SONET RX, and select AUTO with the **PATTERN** switch.

2.14.4 Dropping DS1 Channel from SONET VT1.5 Payload

A DS1 channel can also be dropped directly from a SONET signal containing VT1.5 payloads received at the STS-1, OC-1, OC-3, OC-12, or OC-48 RECEIVE connector. To drop the DS1 channel from a VT1.5 mapped signal, set the following switches:

DS1 SOURCE switch (310-1) — Set to SONET DROP.

Channel Control switch (310) — Set to SONET-STS to select the correct SONET STS-1. Set to SONET-VT to select the correct DS1 (VT1.5).

2.15 SIGNAL VERIFICATION

The following indicators and results are used to verify that the DS1/DS0 Analyzer Option has properly acquired the received DS1 signal (see Figure 2-10).

2.15.1 DS1 Status LEDs [10]

The following green Status LEDs provide information about the condition of the received DS1 signal.

T1 Pulses — Illuminates when the DS1/DS0 Analyzer Option detects multiple T1 pulses from one of three DS1 sources: the side-panel DS1 RECEIVE connector, channelized DS3, or SONET DS1 payload. If the received signal is lost, the LED goes out and the DS3 Signal Loss LED illuminates.

Frame Sync — Illuminates when the DS1/DS0 Analyzer Option acquires frame synchronization. If the received framing format is lost, the LED goes out and the Frame Loss LED illuminates.

Pattern Sync — Illuminates when the DS1/DS0 Analyzer Option synchronizes to the test pattern displayed in the PATTERN window. If pattern synchronization is lost, the LED goes out and the DS3 Pattern Loss LED illuminates.

B8ZS — Illuminates when B8ZS clear channel coding is detected in the received DS1 signal. When B8ZS encoding is detected and the **CODE** switch is set to AMI, the message *B8ZS DETECTED* appears in the SUMMARY category. The LED is only active when the **DS1 SOURCE** switch is set to EXT. INPUT (side-panel DS1 RECEIVE connector).

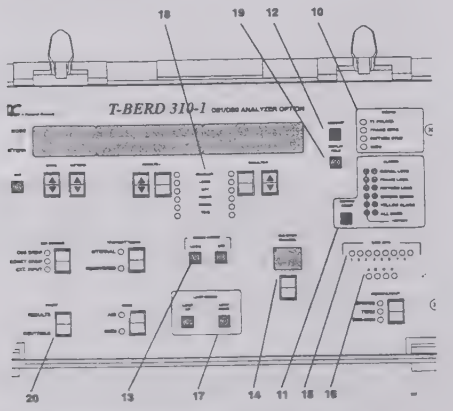


Figure 2-10. Controls and Indicators to Verify Received DS1 Signal

2.15.2 DS1 Alarm LEDs [11]

Red Alarm LEDs provide information about the current and historical alarm conditions related to the received signal. These LEDs are divided into two columns (current and history) as shown in Figure 2-10. The right column illuminates when an alarm condition occurs and remains illuminated as long as the alarm exists. When the current alarm condition is cleared (e.g., pattern sync reestablished), the associated History LED illuminates. The History LEDs indicate past occurrences of the alarm and remain illuminated until either the **HISTORY RESET** switch is pressed or a DS1/DS0 Analyzer Option test restart occurs. The Alarm LEDs are described as follows:

Signal Loss — Illuminates when no pulses are detected. When T1 pulses are detected again, the Alarm LED goes out, and the associated History LED and the T1 Pulses LED illuminate.

Frame Loss — Illuminates when frame synchronization is lost. When DS1 framing is detected again, the Alarm LED goes out, and the associated History LED and the Frame Sync LED illuminate.

Pattern Loss — Illuminates when pattern synchronization is lost. When the pattern is resynchronized, the Alarm LED goes out, and the associated History LED and Pattern Sync LED illuminate.

Excess Zeros — Illuminates when excess zeros are detected in AMI or B8ZS coding. When excess zeros are no longer detected, the LED goes out and the associated History LED illuminates. The LED is only active when the **DS1 SOURCE** switch is set to EXT. INPUT.

Yellow Alarm — Illuminates when a Yellow Alarm is detected. When the Yellow Alarm is no longer detected, the LED goes out and the associated History LED illuminates.

All Ones — Illuminates when all ones are detected in an unframed DS1 signal. When All Ones are no longer detected, the LED goes out and the associated History LED illuminates.

HISTORY RESET switch — This switch clears all History LEDs on the 310-1. This switch does not restart a test, nor does it affect any of the Alarm LEDs or accumulated results. The switch is not operable when the **DISPLAY HOLD** switch is activated. The **RESTART** switch also clears the History LEDs.

2.15.3 SUMMARY Category Messages

The SUMMARY category provides a convenient way to monitor specific results and measurements without having to search through the other categories. The SUMMARY category also provides a number of messages indicating whether the results are in or out of specification. The SUMMARY category is selected by pressing either the **RESULTS I Category** or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

NOTE

If B8ZS encoding is detected during any part of the test and the **CODE** switch is set to AMI, the message *B8ZS DETECTED* is displayed in the SUMMARY category. The LED is only active when the **DS1 SOURCE** switch is set to EXT. INPUT (side-panel DS1 RECEIVE connector).

During initial acquisition of the received signal, the SUMMARY category should be displayed. The following messages can appear during signal acquisition:

ALL RESULTS UNAVAILABLE — This indicates that the DS1/DS0 Analyzer Option has not detected the received signal.

ALL RESULTS OK — This indicates that the DS1/DS0 Analyzer Option has detected and synchronized to the received signal and that no key results are non-zero or out-of-specification.

When an error is detected, the appropriate result appears in the SUMMARY category window. Refer to Section 2.102 for more information on the test results that appear in the SUMMARY category.

2.16 STARTING AND RUNNING THE TEST

This section explains the controls, indicators, and results used to run a test. The following front-panel controls and indicators are described in this section (see Figure 2-10):

2.16.1 RESTART Switch [12]

Pressing the **RESTART** switch halts the current test, clears all results, clears the Status and Alarm LEDs, resynchronizes the receiver to the received signal, and restarts the test.

NOTE

Pressing one of the following switches also causes a test restart of the 310-1: **MODE, PATTERN, DS1 SOURCE,** and **RECEIVE INPUT**. Changing the AUX-USER1 auxiliary function when the USER1 test pattern is being transmitted also causes a test restart of the 310-1.

2.16.2 ERROR INSERT Switches [13]

The two **ERROR INSERT** switches, **LOGIC** and **BPV**, insert logic errors and BPVs into the data stream individually or simultaneously. The **ERROR INSERT** switches perform the following functions:

LOGIC ERROR INSERT switch — Press the **LOGIC ERROR INSERT** switch to insert single or continuous logic errors into the transmitted DS1 data and overhead bits. A single logic error is inserted when the **LOGIC** switch is pressed for less than 1 second. The switch flashes once indicating a single logic error is inserted. Continuous logic errors are inserted at a 10^{-3} error rate when the **LOGIC** switch is pressed for more than 1 second. The switch flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. Logic error insertion affects the signal transmitted from the side-panel DS1 TRANSMIT connector. It also affects the inserted DS1 signal when the DS1 INSERT mode is selected.

NOTE

The **LOGIC ERROR INSERT** switch is disabled for single error insertion in the Fractional T1 (FT1) mode.

BPV ERROR INSERT switch — Press the **BPV ERROR INSERT** switch to insert single or continuous BPVs into the transmitted DS1 signal. A single BPV is inserted when the **BPV** switch is pressed for less than 1 second. The switch flashes once indicating a single BPV is inserted. Continuous BPVs are inserted at a 10^{-3} error rate when the **BPV** switch is pressed for more than 1 second. The switch flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. BPV insertion only affects the signal transmitted from the side-panel DS1 TRANSMIT connector.

2.16.3 DS0 DROP CHANNEL Switch and Window [14]

This switch selects the DS0 channel dropped from the DS1 signal. The selected DS0 signal appears at the Data Bit LEDs, Channel Signaling Status LEDs, T-BERD 310 speaker, side-panel VF OUT connector, and DATAPORT connector. The selected DS0 channel number (1 to 24) is visible in the channel window above the switch.

2.17 COLLECTING TEST RESULTS

This section describes the available test result categories and the following controls to collect the test results.

2.17.1 Summarized Test Results

The results are divided into six categories. The first and most commonly used category is the SUMMARY category. During the initial test setup procedure, the SUMMARY category displays key non-zero or out-of-specification results. Refer to Section 2.102 for more information on test results. The available categories include:

SUMMARY Category — Lists key results that are non-zero or out-of-specification.
LOGIC Category — Lists pattern bit error related results.
BPV Category — Lists bipolar violation related results.
FRAME Category — List DS1 frame and CRC error related results.
SIGNAL Category — List signal (frequency, level, and loss seconds) related results.
TIME Category — Lists time related results.

2.17.2 RESULTS Switches and Windows [18]

When the mode and pattern are displayed, two results are displayed simultaneously in the RESULTS I and RESULTS II window. The available categories and results are selected with the following switches.

RESULTS I and RESULTS II Category switches — Selects the category from the list of categories next to the switch. The labeled LEDs illuminate as the category is selected.

RESULTS I and RESULTS II Category switches — Selects the individual results from the indicated category.

2.17.3 DISPLAY HOLD Switch [19]

Pressing the **DISPLAY HOLD** switch temporarily freezes the results and Status and Alarm LEDs for the DS1/DS0 Analyzer Option only (see Figure 2-10). The switch illuminates to indicate the results and LEDs are frozen. During the display hold, all results can be examined using the **RESULTS** switches. The results continue to accumulate in the background. When the **DISPLAY HOLD** switch is released, the results and LEDs are updated.

2.18 PRINTING THE TEST SETUP AND RESULTS

The DS1/DS0 Analyzer Option provides manual test result and front-panel control printouts through the **PRINT [310]** switch. The T-BERD 310 PRINT auxiliary group determines the DS1/DS0 Analyzer Option printout format and interval. Refer to Section 3 for additional information.

2.16.4 Data Bit LEDs [15]

The eight yellow LEDs indicate the contents of the selected DS0 channel. The Data Bit LEDs are not illuminated when frame synchronization is lost.

2.16.5 Channel Signaling Status LEDs [16]

The four LEDs, labeled A, B, C, and D, indicate the T1 ESF channel signaling status of the selected DS0 channel. LEDs A and B also indicate the T1 D4 and T1 SLC channel signaling status of the selected DS0 channel. The channel signaling status LEDs only respond to signaling after frame synchronization is established. All 24 DS0 channel signaling bits are displayed in the SIGNAL category "abcd" result.

2.16.6 LOOP CODES Switches [17]

The **LOOP UP** and **LOOP DOWN** switches are used to generate loop codes to place CSUs or other facilities into loopback or release them from a loopback. When either switch is pressed, test restart occurs, the loop code is transmitted, and a loop code message appears in place of the displayed test pattern (in the PATTERN window). When the loop code transmission is completed, the DS1/DS0 Analyzer Option returns to transmitting the selected test pattern (the pattern reappears in the window). The AUX-LP CODE auxiliary function selects the loop code type being transmitted. Four different loop codes can be selected (FACILITY 1, FACILITY 2, CSU, and PROGRAMMABLE).

LOOP UP switch — This switch controls the transmission of the loop-up code selected through the AUX-LP CODE auxiliary function. When the **LOOP UP** switch is pressed, the LED inside the switch illuminates and the loop-up code is transmitted. The loop code is transmitted continuously until (1) the loop-up code is detected by the DS1/DS0 Analyzer Option receiver for 250 ms, (2) the **LOOP UP** switch is pressed again, or (3) the **LOOP DOWN** switch is pressed. One of the following loop-up messages appear in the PATTERN window when a loop-up code is transmitted:

CSU LPUP	The CSU loop-up code is being transmitted
FAC1 LPUP	The facility 1 loop-up code is being transmitted
FAC2 LPUP	The facility 2 loop-up code is being transmitted
PGM LPUP	The programmable loop-up code is being transmitted

LOOP DOWN switch — This switch controls the transmission of the loop-down code selected through the AUX-LP CODE auxiliary function. When the **LOOP DOWN** switch is pressed, the LED inside the switch illuminates and the loop-down code is transmitted. The loop code is transmitted continuously until either (1) the loop-down code is no longer detected by the DS1/DS0 Analyzer Option receiver, (2) the **LOOP DOWN** switch is pressed again, or (3) the **LOOP UP** switch is pressed. One of the following loop-down messages appear in the PATTERN window when a loop-down code is transmitted:

CSU LPDN	The CSU loop-down code is being transmitted
FAC1 LPDN	The facility 1 loop-down code is being transmitted
FAC2 LPDN	The facility 2 loop-down code is being transmitted
PGM LPDN	The programmable loop-down code is being transmitted

DS1 INSERT/SECONDARY DS3 RECEIVE OPTION (310-3)

2.19 INTRODUCTION

This section describes the 310-3 DS1 Insert/Secondary DS3 Receive Option which allows the T-BERD 310 to insert a DS1 channel into a multiplexed DS3 signal. The option equips the T-BERD 310 with a secondary DS3 receiver.

Figure 2-11 illustrates the signal flow when performing DS1 drop and insert testing. A DS1 signal is inserted into a selected channel of the secondary DS3 receive input. The DS1 signal can be sourced internally from the DS1/DS0 Analyzer Option, or externally from the DS1 insert input. Once the DS1 channel is inserted into the DS3 signal, the full DS3 is transmitted into the network. The DS1 channel can then be looped back into the returning DS3 signal. This DS3 signal is then accepted by the primary DS3 receive input. The DS1 channel can then be dropped and analyzed by either the DS1/DS0 Analyzer Option or by an external DS1 test set.

Additionally, the T-BERD 310 can perform dual DS3 signal monitoring by using the secondary DS3 receiver with the primary DS3 receiver. DS3 signal analysis can be performed simultaneously on both the primary and secondary DS3 input signals.

Appendix B shows the functional block diagram of the T-BERD 310 mainframe and the 310-3 DS1 Insert/Secondary DS3 Receive Option.

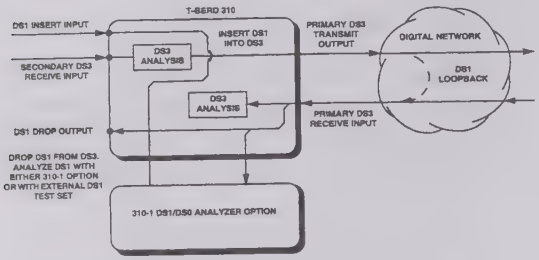

T-BERD 310
DS1 INSERT INPUT
SECONDARY DS3 RECEIVE INPUT
DS1 DROP OUTPUT
DROP DS1 FROM DS3. ANALYZE DS1 WITH EITHER 310-1 OPTION OR WITH EXTERNAL DS1 TEST SET
DS3 ANALYSIS
INSERT DS1 INTO DS3
DS3 ANALYSIS
PRIMARY DS3 TRANSMIT OUTPUT
PRIMARY DS3 RECEIVE INPUT
DIGITAL NETWORK
DS1 LOOPBACK
310-1 DS1/DS0 ANALYZER OPTION

Figure 2-11. DS1 Insert/Secondary DS3 Receive Option Signal Flow Diagram

2.20 INITIAL TEST SETUP

This section describes the controls and indicators used to initially configure the T-BERD 310 to drop and insert a DS1 channel from a DS3 signal. Refer to Figure 2-2 for more information.

2.20.1 MODE/RATE Switch [4]

Press the **MODE** switch to select the DS1 INSERT mode. The DS1 INSERT mode configures the T-BERD 310 to insert a DS1 channel into a secondary DS3 signal. Use the **PATTERN** switch to select the DS1 input source. The T-BERD 310 automatically configures itself to the received secondary DS3 framing.

2.20.2 PATTERN/PAYLOAD Switch [5]

Press the **PATTERN** switch to select the DS1 input source when the DS1 INSERT mode is selected. Select the DS1 input source from one of the following:

EXTERNAL DS1 — Selects the side-panel DS1 INSERT INPUT connector as the source of the DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE connector.

INTERNAL DS1 — Selects the DS1 signal generated by the DS1/DS0 Analyzer Option as the source of the DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE connector. This selection is only available when the DS1/DS0 Analyzer Option is installed.

2.20.3 DS3 TRANSMIT TIMING Switch [6]

When the DS1 INSERT mode is selected, this switch defaults to RECOVD timing. The T-BERD 310 uses the secondary DS3 input signal as the recovered timing source.

2.20.4 DS3-DS1 Channel Control-INSERT Switch [11]

When in the DS1 INSERT mode, this switch selects the DS1 channel to be inserted into the secondary DS3 signal. Each time the **DS3-DS1 Channel Control-INSERT** switch is pressed, the channel number flashes for 3 seconds before the new selection takes affect. This allows the selection to be changed without affecting the test. The **DS3-DS1 Channel Control-INSERT** switch selections include:

1 to 28 — Select the inserted DS1 channel. The remaining 27 DS1 channels are not affected.

— — — (triple dashes) — Select to pass the full secondary DS3 signal. No DS1 channels are inserted.

2.21 TEST CONNECTIONS

The DS1 Insert/Secondary DS3 Receive Option adds two connections to the T-BERD 310: SECONDARY DS3 RECEIVE and DS1 INSERT INPUT connectors (see Figure 2-12). The front-panel DS3 connections provide access to the primary DS3 signal. The side-panel DS1 DROP connector provides access to the dropped DS1 signal.

SECONDARY DS3 RECEIVE connector — This connector is located on the side panel. It allows a secondary DS3 signal to be analyzed and retransmitted from the DS3 TRANSMIT connector. In the DS1 INSERT mode, connect the secondary DS3 signal to the T-BERD 310 first. This allows the T-BERD 310 to synchronize to the secondary DS3 signal before connecting the T-BERD 310 output and interrupting the circuit under test. The connector can accept a DSX-3 or HIGH input level.

DS1 INSERT INPUT connector — This Bantam (new units) or WECO 310 (old units) connector accepts a DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE connector. The connector can accept a DSX-1 input level.

Figure 2-12. DS1 Insert/Secondary DS3 Receive Option Connections

The DS3 TRANSMIT connector retransmits the secondary DS3 signal containing the inserted DS1 channel.

2.22 SIGNAL VERIFICATION

This section describes the following controls, indicators, and results used to verify that the T-BERD 310 has properly acquired the received secondary DS3 signal (see Figure 2-13).

2.22.1 DS3 Secondary Status LEDs [1]

The green DS3 Secondary Status LEDs provide information about the current condition of the received secondary DS3 signal. The DS3 Secondary Status LEDs perform the same functions as described in Section 2.4.1 with the exception of the DS2 Frame Sync LED. The DS2 Frame Sync LED illuminates when the T-BERD 310 synchronizes to the DS2 framing format which corresponds to the inserted DS1 channel. The T-BERD 310 must be synchronized with the DS2 framing format before a DS1 signal can be inserted. If the received DS2 framing format is lost, the LED goes out, the DS2 Frame Loss LED illuminates, and the DS1 insertion is discontinued.

2.22.2 DS3 Secondary Alarm LEDs [2]

The red DS3 Secondary Alarm LEDs provide information about the current and historical alarm conditions related to the received secondary DS3 signal. The DS3 Secondary Alarm LEDs perform the same functions as described in Section 2.4.2 with the exception of the DS2 Frame Loss LED. The DS2 Frame Loss LED illuminates when the T-BERD 310 loses DS2 frame synchronization which corresponds to the inserted DS1 channel. When the DS2 framing is detected again, the LED goes out and the associated DS3 History LED and DS2 Frame Sync LED illuminate.

2.22.3 RESULTS I and RESULTS II SECONDARY Switches [3]

Press either switch to select the Secondary DS3 results. The **SECONDARY** switch illuminates when the Secondary DS3 results are displayed. The SUMMARY, BPV, PARITY, FRAME, and SIGNAL categories are available when the **SECONDARY** switch is pressed. The Secondary SUMMARY category performs the same function as described in Section 2.4.3 except for the Secondary DS3 signal.

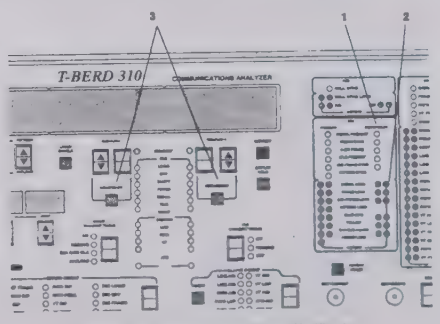


Figure 2-13. Secondary DS3 Signal Verification

2.23 COLLECTING TEST RESULTS

The Secondary DS3 category results are divided into five categories. They are only available when the **RESULTS I** or **RESULTS II SECONDARY** switch illuminates. During the initial test set-up procedure, the SUMMARY category displays key results that are non-zero or out-of-specification. Refer to Section 2.89 for additional information on selecting and collecting the test results. When the Secondary DS3 signal is analyzed, the primary DS3 category results are also available. Table 2-4 lists the available Secondary DS3 category test results.

Table 2-4. Secondary DS3 Test Results

Category	Test Result
SUMMARY	VIOLATIONS (BPV Category)
	FRM ERRORS (FRAME Category)
	PAR ERRORS (PARITY Category)
	C-BIT ERRORS (PARITY Category)
	FEBE (PARITY Category
	RX FREQ Hz (SIGNAL Category)
	FEAC Messages
BPV	VIOLATIONS — Bipolar Violations
	BPV ERR RT — BPV Error Rate
	AV BPV ERT — Average BPV Error Rate
	BPV ERR SEC — BPV Errored Seconds
	BPV %EFS — BPV, Percentage of Error-Free Seconds
PARITY	PAR ERRORS — Parity (P-bit) Errors
	PAR ERR RT — Parity (P-bit) Error Rate
	AV PAR ERT — Average Parity (P-bit) Error Rate
	PAR ERR SEC — Parity (P-bit) Errored Seconds
	PAR %EFS — Parity (P-bit), Percentage of Error-Free Seconds
	C-BIT ERRORS — C-bit Parity Errors
	C-BIT ERR RT — C-bit Parity Error Rate
	AV C-BIT ERT — Average C-bit Parity Error Rate
	C-BIT TYPE A — C-bit Parity Errored Seconds, Type A
	C-BIT TYPE B — C-bit Parity Errored Seconds, Type B
	C-BIT TYPE C — C-bit Parity Errored Seconds, Type C
	C-BIT %EFS — C-bit Parity Percentage of Error-Free Seconds
	FEBE — Far-End Block Errors
	FEBE RT — Far-End Block Error Rate
	AV FEBE RT — Average Far-End Block Error Rate
	FEBE TYPE A — Far-End Block Errored Seconds, Type A
	FEBE TYPE B — Far-End Block Errored Seconds, Type B
	FEBE TYPE C — Far-End Block Errored Seconds, Type C
	FEBE %EFS — Far-End Block Error, Percentage of Error-Free Seconds
FRAME	FRM ERRORS — Frame Errors
	FRM ERR RT — Frame Error Rate
	AV FRM ERT — Average Frame Error Rate
	FRM ERR SEC — Frame Errored Seconds
	FRM %EFS — Frame, Percentage of Error-Free Seconds
SIGNAL	RX FREQ — Received Frequency in Hertz

2.24 PRINTING THE TEST SETUP AND RESULTS

Secondary DS3 results are printed with the primary DS3 results. The secondary DS3 results can be customized through the PRINT-CUSTOM auxiliary function. Press the **RESULTS VII SECONDARY** switch to select the desired secondary DS3 results for the customized test results printout. Refer to Section 3 for more information on printing the results. Refer to Appendix A for a list of alarm, status, and note messages that apply to the primary and secondary input signal analysis.

DS3 JITTER OPTION (310-5)

2.25 INTRODUCTION

This section describes the 310-5 DS3 Jitter Option which allows the T-BERD 310 to measure wideband and highband jitter in the received DS3 signal. The option provides test results that measure the amplitude of the wideband and highband jitter in Unit Intervals (UIs). One UI equals (22.35 ns) the period of a DS3 44.736 MHz master clock. The option also provides a demodulated jitter output that can drive a spectrum analyzer to determine the component amplitudes and frequencies of the jitter.

Appendix B shows the functional block diagram of the T-BERD 310 mainframe and the DS3 Jitter Option.

2.26 INITIAL TEST SETUP

DS3 jitter can be measured from the DS3 signal received through the DS3 RECEIVE connector. To obtain the most accurate jitter measurements, allow the T-BERD 310 to warm up for at least 3 minutes.

During the initial configuration of the T-BERD 310, the JITTER auxiliary group should be checked and modified if required to measure the primary DS3 input signal for jitter. Press the **AUX** switch to select the auxiliary functions, and press the **MODE** switch to select the JITTER auxiliary group. Refer to Section 2.72 for more information on JITTER auxiliary functions.

2.27 TEST CONNECTIONS

The DS3 signal into the DS3 RECEIVE connector is the only DS3 input signal that can be tested for jitter. The side-panel JITTER OUTPUT BNC connector is describes in Figure 2-14.

JITTER OUTPUT BNC connector — Provides a demodulated 1 Vp-p signal across a 50 ohm termination. The JITTER-JIT FILTER auxiliary function controls the bandwidth of the JITTER OUTPUT signal. When either the JITTER-JIT FILTER or JITTER-JIT SCALE auxiliary function is set to AUTO, the JITTER OUTPUT signal is disabled.

Figure 2-14. 310-5 DS3 Jitter Option Connection

2.28 SIGNAL VERIFICATION

The DS3 jitter measurements can only be obtained when a valid DS3 signal is received. The DS3 Primary Signal Present LED should be illuminated to verify that a valid DS3 signal is received. When the DS3 Primary Signal Loss LED illuminates, the WB JITTER and HB JITTER results are not available. The MAX WB JIT and MAX HB JIT results are frozen by signal loss.

2.29 COLLECTING TEST RESULTS

The jitter amplitude test results are found in the SIGNAL category and are dependent on the JITTER auxiliary group settings. Table 2-5 shows the SIGNAL category following jitter test results:

Table 2-5. Jitter Test Results

Displayed Result	Description
WB JITTER	Wideband Jitter
MAX WB JIT	Maximum Wideband Jitter
HB JITTER	Highband Jitter
MAX HB JIT	Maximum Highband Jitter

The message *UNAVAILABLE* appears in the result when the jitter option is initializing; after test restart; and in the AUTO mode when the T-BERD 310 is searching for the proper scale. When the combined frequency and amplitude exceed the selected hardware filter and scale, the message *OUT OF RANGE* appears in the result. The JITTER-JIT THRESH auxiliary function can be used to set the jitter threshold to display the MAX WB JIT and MAX HB JIT test results in the SUMMARY category when the threshold is exceeded.

2.30 INTRODUCTION

This section describes the option configurations, instrument setup, auxiliary functions, and test results for the following T-BERD 310 Synchronous Optical Network (SONET) options.

310-12 SONET OC-12, OC-12c Transmit/Receive Option — Provides both SONET transmit and receive signals, OC-12c, OC-3c, DS3, and DS1 payload drop and insert, and through mode capabilities at the OC-12 rate. The 310-14R and 310-14T pair (310-14R/T pair) option is required to support this option. Two versions of this option are available: 1300 nm transmit wavelength (310-12-1300), and both 1300 nm/1500 nm transmit wavelength (310-12-DUAL).

310-13R SONET STS-1 Receive Option — Provides receive signal and payload drop capabilities at the STS-1 rate. SONET DCC drop and insert (310-13T required) capabilities are also provided.

310-13T SONET STS-1 Transmit Option — Provides transmit signal and payload insert capabilities at the STS-1 rate. SONET orderwire drop (310-13R required) and insert capabilities and a DS1 BITS clock input are also provided.

310-14R SONET STS-1, OC-1/3/3c Receive Option — Provides receive signal and OC-3c (OC-3 only), DS3, and DS1 payload drop capabilities at the STS-1, OC-1, and OC-3 rates. SONET DCC drop and insert (310-14T required) capabilities are also provided.

310-14T SONET STS-1, OC-1/3/3c Transmit Option — Provides transmitted signal and OC-3c (OC-3 only), DS3, and DS1 payload insert capabilities at the STS-1, OC-1, and OC-3 rates. SONET orderwire drop and insert (310-14R required) capabilities and a DS1 BITS clock input are also provided. Two versions of this option are available: 1300 nm transmit wavelength (310-14T-1300), and both 1300 nm/1500 nm transmit wavelength (310-14T-DUAL).

310-21 SONET OC-48 Transmit/Receive Option — Provides both SONET transmit and receive signals, OC-48c, OC-3c, DS3, and DS1 payload drop and insert, and through mode capabilities at the OC-48 rate. The 310-14R and 310-14T pair (310-14R/T pair) option and 310-12 options are required to support this option. Three versions of this option are available: 1300 nm transmit wavelength (310-21-1300), 1550 nm transmit wavelength (310-21-1550), and both 1300 nm/1550 nm transmit wavelength (310-21-DUAL).

The SONET options enable the T-BERD 310 to transmit and receive SONET signals from a Synchronous Transport Signal - Level 1 (STS-1), Optical Carrier - Level 1 (OC-1), OC-3, OC-3c, OC-12, or OC-48c.

The T-BERD 310 can analyze the SONET STS-1, OC-1/3/3c, OC-12, and OC-48 signal overhead, and drop or insert DS3 and DS1 payloads. The DS1 payload can be dropped to either the DS1/DS0 Analyzer Option or an external DS1 test set. Floating asynchronous and floating bit-synchronous DS1 mapping formats are supported in all options. Floating byte-synchronous DS1 mapping is supported by the 310-13R/T pair and 310-14R/T pair options.

Appendix B shows the functional block diagram of the T-BERD 310 mainframe and the SONET options.

2.30.1 Cautions for Optical Connections

The following cautions must be observed before and during all phases of instrument operation.

Use of controls, adjustments or procedures other than those specified herein may result in hazardous laser light exposure.

WARNING

DO NOT LOOK DIRECTLY INTO THE T-BERD 310 OPTICAL OUTPUT

The T-BERD 310 optical source is designed for safe Class I operation. However, it is recommended that you not look directly into the optical output of the instrument or at the output of any optical cable connected to the instrument. If a fiber optic connection is removed from a transmitting connector, screw the safety cap onto the connector to prevent inadvertent exposure to the laser output.

ALWAYS USE COMPATIBLE CONNECTORS

When making optical connections, use compatible connector types. DO NOT ATTEMPT TO MATE INCOMPATIBLE CONNECTORS. Connector ends are fragile and become unusable when damaged.

CLEAN FIBER OPTIC CONNECTORS BEFORE USE

Keep fiber optic connectors free of dust and debris by cleaning them before each use. Fiber optic connectors are delicate and can be damaged easily by small bits of dirt or debris on the end of the connector. Once a fiber optic connector on the T-BERD 310 is damaged, it must be replaced at the factory.

KEEP SAFETY CAP ON THE CONNECTOR WHEN NOT IN USE

When the T-BERD 310 is not being used, screw the safety cap(s) on the connector(s) to keep the optical connection clean and to minimize damage to the fiber.

2.30.2 Cleaning Optical Connectors

A clean fiber optic surface is essential for accurate test results and to protect fiber optic surfaces from abrasive dirt particles.

****
* CAUTION *
****

Fiber optic connectors are delicate and can be damaged easily. Once damaged, the T-BERD 310 connector must be replaced at the factory. Therefore, clean the T-BERD 310 connector and the mating connectors often.

When the T-BERD 310 is used in a low-dust environment, minimal amounts of dirt and debris are expected on the connectors. Therefore, the following cleaning procedure is sufficient to maintain the connectors contamination free and protect the fiber from damage.

1. **TRANSMIT or RECEIVE OC-1, OC-3, OC-12, or OC-48 optical connections**
   Remove the safety cap from the fiber optic connector.
2. **Clean fiber optic surfaces**
   Carefully clean the fiber optic connector and cable ends with a cotton swab dipped in alcohol or an alcohol wipe.
3. **Dry fiber optic surfaces**
   Wipe the fiber optic connector and cable ends with a clean, dry swab.
4. **Repeat as necessary**
   Repeat approximately every tenth usage or more if the T-BERD 310 is operated in a dusty environment. Replace safety cap after each test.

2.31 INITIAL TEST SETUP

The following controls and indicators (see Figure 2-15) are used to initially configure the T-BERD 310 to test SONET signals.

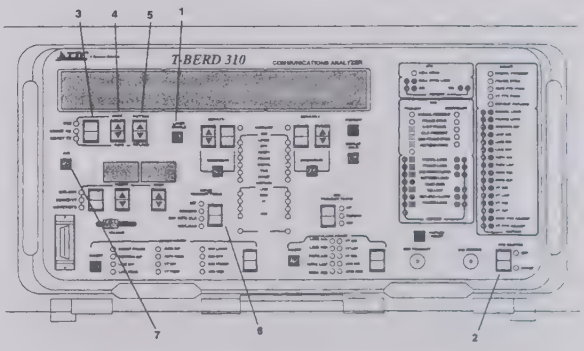


Figure 2-15. SONET Test Setup Controls and Indicators

2.31.1 LASER ENABLE Switch [1]

The **LASER ENABLE** switch provides manual control and a visual indicator of the laser output status on the 310-14T, 310-12, or 310-21 SONET option. The switch illuminates when a laser is activated by either pressing the switch or selecting the output rate (OC-1, OC-3, OC-12, or OC-48) with the **RATE** switch (**Setup** switch set to SONET TX). The laser output is deactivated by either pressing the illuminated **LASER ENABLE** switch or selecting STS-1 with the **RATE** switch (**SETUP** switch set to SONET TX). The switch is only active when the 310-14T, 310-12, or 310-21 SONET Option is installed. If the laser source is on (**LASER ENABLE** switch illuminated) when power is cycled (on-off-on), the laser source cycles as well. This allows long term tests to continue after a power loss. Use appropriate precautions to prevent accidental exposure to the laser output.

The **LASER ENABLE** switch is inoperative if no SONET transmit options are installed, if the unit is set up for STS-1 testing, or if the 310-13T is installed.

2.31.2 DS3 SOURCE Switch [2]

Press this switch to test a DS3 signal from either a side-panel SONET input connection or the front-panel DS3 RECEIVE connector. The DS3 Primary Status LEDs, DS3 Alarm LEDs and test results apply to the selected DS3 signal. The switch selections include:

EXT — Selects the DS3 RECEIVE connector.

SONET — Selects the side-panel SONET connections which are selected with the **SETUP** switch.

2.31.3 SETUP Switch [3]

The **SETUP** switch selects the way mode and test pattern or rate and payload information is changed and displayed on the left-most third of the front-panel display. (The **RATE** and **PAYLOAD** switches to effect changes to the SONET transmit and receive signals: see the **RATE** and **PAYLOAD** switch sections below).

The **SETUP** switch selections include DS3, SONET RX and SONET TX settings, as listed below.

DS3 selection — See the DS3 Testing section for information on the DS3 setting.

SONET RX selection — The SONET RX selection can only be selected when the 310-12, 310-13R, 310-14R, or 310-21 option is installed. When SONET RX is selected, the **RATE** switch selects the receive SONET rate, and the **PAYLOAD** switch selects the inserted payload type.

SONET TX selection — The SONET TX selection can only be selected when the 310-12, 310-13T, 310-14T, or 310-21 option is installed. Choosing SONET TX allows selection of the SONET output transmit rate, connection, and STS on which to perform payload insertion. When SONET TX is selected, the **RATE** switch selects the transmit SONET rate, and the **PAYLOAD** switch selects the inserted payload type.

2.31.4 MODE/RATE Switch [4]

2.31.4.1 SONET RX Selection

When SONET RX is selected, the **RATE** switch selects the receive SONET rate. Select from the following SONET receive rates:

STS-1 — Selects the side-panel STS-1 RECEIVE connector to analyze an STS-1 signal. Set the receive level with the SONET RX-STS RX LEVEL auxiliary function.

OC-1 — Selects the side-panel OC-1/OC-3 RECEIVE connector to analyze an OC-1 signal.

OC-3 — Selects the side-panel OC-1/OC-3 RECEIVE connector to analyze an OC-3 signal. Press the **CHANNEL CONTROL** and **DROP** switches to select the STS ID number (1, 2, or 3).

OC-12 — Selects the side-panel OC-12 RECEIVE connector on the installed 310-12 option to analyze an OC-12 signal. Press the **CHANNEL CONTROL** and **DROP** switches to select the STS ID number (1 to 12).

OC-48 — Selects the side-panel OC-48 RECEIVE connector on the installed 310-21 option to analyze an OC-48 signal. Press the **CHANNEL CONTROL** and **DROP** switches to select the STS ID number (1 to 48). If the rate is OC-48, the valid STS range is 1 to 48. If the payload is an OC-48c rate, then the **DROP** switch should be locked to the value of 1. The default setting is STS ID 1.

STM-1 — For information on this selection, refer to Section 2.51.

STM-4 — Only supports concatenated payload types.

STM-16 — Only supports concatenated payload types.

NOTE

To analyze an OC-3c tributary, select either OC-3, OC-12, or OC-48 to select the appropriate OC-3, OC-12 or OC-48 RECEIVE connection. If you select an STS ID that is part of an OC-3c tributary, the entire OC-3c signal is analyzed.

2.31.4.2 SONET TX Selection

When SONET TX is selected, the **RATE** switch selects the output transmit rate, connection, and STS on which to perform payload insertion. This auxiliary function is only available when the 310-13T or 310-14T option is installed. For OC-3c, OC-12c, and OC-48 STS Insert selection is forced to ALL.

For OC-12, the STS insert selection varies depending on the STS inserted. The 310-12 option receives the STS signals for insert from the OC-1/3 options. When selecting an STS-1 for insert, the STS-1 can be placed in any of the 12 OC-12 IDs. The OC-12 option takes the STS-1 from the OC-1/3 option, and uses STS # 1 to insert into the selected slot, and replicates STS #2 across the other 11 STSs.

When inserting an OC-3c signal, this signal is received from the OC-1/3 option as three consecutive STSs. These can be inserted at STS 1, 4, 7, or 10, as three consecutive STS's. STS IDs that are not selected for payload insert are marked unequipped at the path layer.

To transmit an OC-3c tributary, select either OC-3, OC-12, or OC-48 to select the appropriate OC-3, OC-12 or OC-48 TRANSMIT connection. Then, set the **CHANNEL CONTROL** switch to SONET-VT. When inserting (or generating) an OC-3c tributary signal, the STS ID is not selectable (ALL appears). The same OC-3c signal is generated for the OC-3 payload and for all four OC-12 payload slots.

Select from one of the following SONET outputs.

STS-1 — Selects the side-panel STS-1 TRANSMIT connector to transmit an STS signal. Set the output level with the SONET TX-STS TX LEVEL auxiliary function.

OC-1 — Selects the side-panel OC-1/OC-3 TRANSMIT connector to transmit an OC-1 signal.

OC-3 — Selects the side-panel OC-1/OC-3 TRANSMIT connector to transmit an OC-3 signal. Press the **CHANNEL CONTROL and INSERT** switches to select the STS ID number (1, 2, or 3) or ALL. Select an STS ID number to insert a test signal into the STS signal. Select ALL to insert a test signal into all STSs.

OC-12 — Selects the side-panel OC-12 TRANSMIT connector on the installed 310-12 option to transmit an OC-12 signal. Press the **CHANNEL CONTROL and INSERT** switches to select the STS ID number (1 to 12) or ALL. Select an STS ID number to insert a test signal into the STS signal. Select ALL to insert a test signal into all STSs.

OC-48 — Selects the side-panel OC-48 TRANSMIT connector on the installed 310-21option to transmit an OC-48 signal. Press the **CHANNEL CONTROL and INSERT** switches to select the STS ID number to insert a test signal into all STSs.

STM-1 —For information on this selection, refer to Section 2.51.

STM-4 — Only supports concatenated payload types.

STM-16 — Only supports concatenated payload types.

THRU (SONET THRU Mode) — Connects a SONET receiver input with the appropriate SONET transmitter output, i.e., STS-1 in to STS-1 out, OC-1 in to OC-1 out, OC-3 in to OC-3 out, OC-12 in to OC-12 out, and OC-48 in to OC-48 out. Select the rate and connections by setting the **SETUP** switch to SONET RX. Payloads can be dropped from the received SONET signal. Frame word errors, Section BIP errors, and Line BIP errors can be inserted. Alarms, payloads, DCC, and orderwire channels cannot be inserted into the transmitted signal. If the received signal is not present at the appropriate input connection, Line AIS is transmitted. The insert functions of the T-BERD 310 can be configured, but they do not have any effect on the transmitted SONET signal. Transmit timing defaults to recovered. This function only appears with the installed 310-13R/T pair or 310-14R/T pair option.

2.31.4.3 SONET Remote Control Commands

The following remote control commands mirror the operation of the auxiliary functions.

SONet INPut [STS-1 | OC-1 | OC-3 | OC-12 | OC-48 | STM-1 | STM-4 | STM-16]
SONet INPut ?

SONet STS ID [RX] [1 .. 48]
SONet STS ID [RX] ?

SONet OUTput [STS-1 | OC-1 | OC-3 | OC-12 | OC-48 | THRU | STM-1 | STM-4 | STM -16]
SONet OUTput ?
SONet STS ID TX [1 .. 48 | ALL]
SONet STS ID TX ?

In order to maintain backward compatibility with existing remote control commands, the SONET STS ID RX accepts these commands without the RX portion.

2.31.5 PATTERN/PAYLOAD Switch [5]

2.31.5.1 SONET RX Selection

When SONET RX is selected, the **PAYLOAD** switch selects the dropped payload signal type and DS1 channel for VT1.5 signal analysis, if applicable. This function is only available when the 310-12, 310-13R, 310-14R, or 310-21 option is installed. Select from the following payload formats.

AUTO — The T-BERD 310 automatically determines the payload type from the payload information itself. When the T-BERD 310 determines the payload format, the payload name appears in lowercase characters replacing AUTO as follows:

ds3 asyn — Appears when a DS3 asynchronous payload is detected in the selected STS ID

ds1 asyn — Appears when a DS1 asynchronous payload is detected in the selected STS ID and DS1 channel

ds1 bit — Appears when a DS1 bit-synchronous payload is detected in the selected STS ID and DS1 channel

ds1 byte — Appears when a DS1 byte-synchronous payload is detected in the selected STS ID and DS1 channel

concat (3c) — Appears when an OC-3c tributary, or no specific OC-3c pattern or data is detected in a concatenated OC-3 signal. It may also appear if the T-BERD 310 has not been equipped with the latest SONET features. It can also appear for an OC-3c ATM tributary if the OC-3c ATM Analysis Option is not installed or ATM cells are not recognized.

2^23-1 (3c) — Appears when an OC-3c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

!2^23-1 (3c) — Appears when an inverted OC-3c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

concat (12c) — Appears when no specific OC-12c pattern or data is detected in a concatenated OC-12 signal.

2^23-1 (12c) — Appears when an OC-12c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

!2^23-1 (12c) — Appears when an inverted OC-12c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

concat (48c) — Appears when no specific OC-48c pattern or data is detected in a concatenated OC-48 signal.

2^23-1 (48c) — Appears when an OC-48c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

!2^23-1 (48c) — Appears when an inverted OC-48c 2^23-1 pseudorandom pattern is detected in the selected STS ID group.

2^31-1 (48c) — Appears when an OC-48c 2^31-1 pseudorandom pattern is detected in the selected STS ID group.

!2^31-1 (48c) — Appears when an inverted OC-48c 2^31-1 pseudorandom pattern is detected in the selected STS ID group

atm (3c) — Appears when an OC-3c ATM payload is detected in the incoming signal.

atm (12c) — Appears when an OC-12c ATM payload is detected in the incoming signal.

unknown — Appears when one of the previous payloads cannot be detected in the selected STS ID. AIS is dropped in place of the DS3 and DS1 payloads.

AUTO appears until one of the previous payload types is detected. If the last payload is lost, or a test restart occurs, AUTO continues to scan for it.

NOTE

AUTO mode cannot declare bit synchronization on a DS1 bit-synchronous payload, it is an undetectable format of a DS1 asynchronous payload.

Scanning can also be manually controlled by selecting one of the following payload types:

DS3 ASYN — Analyzes a DS3 asynchronous payload from the selected STS ID

DS1 ASYN — Analyzes a DS1 asynchronous payload from the selected STS ID and DS1 channel.

DS1 BIT — Analyzes a DS1 bit-synchronous payload from the selected STS ID and DS1 channel.

DS1 BYTE — Analyzes a DS1 byte-synchronous payload from the selected STS ID and DS1 channel.

NOTE

The CONCAT (3c, 12c, 48c) and ATM (3c, 12c) payload types below can only be selected when OC-3, OC-12, or OC-48 is selected.

CONCAT (3c) — Analyzes an OC-3c tributary from the selected STS ID group of OC-3 signals.

2^23-1 (3c) — Analyzes the OC-3c 2^23-1 pseudorandom pattern from the selected STS ID group.

I2^23-1 (3c) — Analyzes the inverted OC-3c 2^23-1 pseudorandom pattern from the selected STS ID group.

CONCAT (12c) — Analyzes an OC-12c tributary from the selected STS ID group of OC-12 signals.

2^23-1 (12c) — Analyzes the OC-12c 2^23-1 pseudorandom pattern from the selected STS ID group.

I2^23-1 (12c) — Analyzes the inverted OC-12c 2^23-1 pseudorandom pattern from the selected STS ID group.

CONCAT (48c) — Analyzes an OC-48c tributary from the selected STS ID group of OC-48 signals.

2^23-1 (48c) — Analyzes the OC-48c 2^23-1 pseudorandom pattern from the selected STS ID group.

I2^23-1 (48c) — Analyzes the inverted OC-48c 2^23-1 pseudorandom pattern from the selected STS ID group.

2^31-1 (48c) — Analyzes the OC-48c 2^31-1 pseudorandom pattern from the selected STS ID group.

I2^31-1 (48c) — Analyzes the inverted OC-48c 2^31-1 pseudorandom pattern from the selected STS ID group.

ATM (3c) — Analyzes an OC-3c ATM tributary from the selected STS ID group of either an OC-3 or OC-12 signal. Requires either the OC-3c ATM Analysis Option or OC-12c Payload and ATM Analysis Option, respectively. Refer to Section 2.36 for additional information.

ATM (12c) — Analyzes an OC-12c ATM tributary from the selected STS ID group of either an OC-12 or OC-48 signal. Requires the OC-48c Payload and ATM Analysis Option. Refer to Section 2.36 for additional informanon.

SONET VT1.5s may be mapped by transmission equipment either sequentially or by VT Group/VT. The MISC-DS1/VT MAP auxiliary function selects each mapping type (e.g., when having difficulty locating a particular VT1.5).

2.31.5.2 SONET TX Selection

When the SONET TX is selected, the **PAYLOAD** switch selects the inserted payload type. Select from the following payload formats and sources.

DS3 ASYN INT — Inserts a T-BERD 310 internally generated DS3 asynchronous signal into the selected STS ID.

DS3 ASYN EXT — Inserts an externally generated DS3 asynchronous signal from the DS3 RECEIVE connector into the selected STS ID. If the DS3 signal is lost, Path AIS is transmitted on the selected STS ID.

DS1 ASYN INT — Inserts a DS1/DS0 Analyzer Option internally generated DS1 asynchronous signal into the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

DS1 ASYN EXT — Inserts an externally generated DS1 asynchronous signal from the DS1/DS0 Analyzer Option DS1 RECEIVE connector into the selected STS ID. If the DS1 signal is lost, VT AIS is transmitted on the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

DS1 BIT INT — Inserts a DS1/DS0 Analyzer Option internally generated DS1 bit-synchronous signal into the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

DS1 BIT EXT — Inserts an externally generated DS1 bit-synchronous signal from the DS1/DS0 Analyzer Option DS1 RECEIVE connector into the selected STS ID. If the DS1 signal is lost, VT AIS is transmitted on the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

DS1 BYTE INT — Inserts a DS1/DS0 Analyzer Option internally generated DS1 byte-synchronous signal into the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

DS1 BYTE EXT — Inserts an externally generated DS1 byte-synchronous signal from the DS1/DS0 Analyzer Option DS1 RECEIVE connector into the selected STS ID. This is not available in older units. If the DS1 signal is lost or DS1 frame synchronization is not present or lost, VT AIS is transmitted on the selected STS ID. The DS1 channel or group and VT number appears in the RESULTS II window.

NOTE

The previous DS1 selections only appear when the DS1/DS0 Analyzer Option is installed.

PATH UNEQ — Inserts a Path unequipped signal and the selected STS ID payload is marked unequipped.

VT1.5 UNEQ — Inserts a VT1.5 unequipped signal and each VT1.5 payload is marked unequipped.

CONCAT (3c) — Generates an OC-3c tributary signal with a fixed pattern in the payload (55 hex). CONCAT (3c) only appears when **OC-3, OC-12,** or **OC-48** is selected with the **SETUP** switch set to SONET TX.

2^23-1 (3c) — Inserts the OC-3c 2^23-1 pseudorandom pattern into ALL STS ID groups.

I2^23-1 (3c) — Inserts the inverted OC-3c 2^23-1 pseudorandom pattern into ALL STS ID groups.

CONCAT (12c) — Generates an OC-12c tributary signal with a fixed pattern in the payload (55 hex). CONCAT (12c) only appears when **OC-3, OC-12,** or **OC-48** is selected with the **SETUP** switch set to SONET TX.

2^23-1 (12c) — Inserts the OC-12c 2^23-1 pseudorandom pattern into ALL STS ID groups.

I2^23-1 (12c) — Inserts the inverted OC-12c 2^23-1 pseudorandom pattern into ALL STS ID group.

CONCAT (48c) — Generates an OC-48c tributary signal with a fixed pattern in the payload (55hex). CONCAT(48c) only appears when OC 48 is selected with the Setup switch set to SONET TX.

2^23-1 (48c) — Inserts the OC-48c 2^23-1 pseudorandom pattern in ALL STS ID groups.

I2^23-1 (48c) — Inserts the inverted OC-48c 2^23-1 pseudorandom pattern in ALL STS ID groups.

2^31-1 (48c) — Inserts the OC-48c 2^31-1 pseudorandom pattern in ALL STS ID groups.

I2^31-1 (48c) — Inserts the inverted OC-48c 2^31-1 pseudorandom pattern into ALL STS ID groups.

ATM (3c) — Generates an ATM signal. ATM (3c) only appears when **OC-3** or **OC-12** is selected with the **SETUP** switch set to SONET TX. Requires the OC-3c ATM Analysis Option.

ATM (12c) — Generates an ATM signal. ATM (12c) only appears when **OC-12** is selected with the **SETUP** switch set to SONET TX. Requires the OC-12c ATM Payload and Analysis Option.

(thru mode) — Appears when the SONET THRU mode is selected with the **SETUP** switch set to SONET TX.

SONET VT1.5s may be mapped by transmission equipment either sequentially or VT Group/VT. The MISC-DS1/VT MAP auxiliary function selects each mapping type (e.g., when having difficulty locating a particular VT1.5).

2.31.6 SONET TRANSMIT TIMING Switch [6]

When the SONET transmit option is installed this switch determines the SONET transmit timing source. Of the four available selections, three are user-selectable, and one (PAYLOAD) is "forced".

INT — Selects an internal clock to transmit the SONET signal.

RECOVD — Selects the clock generated from the received SONET signal which is selected by setting the **SETUP** switch to SONET RX. This is the default timing source when the T-BERD 310 is operating in SONET THRU mode. It is only available with the installed 310-13R or 310-14R option. This LED flashes if the SONET receive frequency is out of tolerance or is missing. When the RECOVD LED is flashing the T-BERD 310 transmits the SONET signal using internal timing.

DS1 BITS CLK — Selects the timing source connected to the side-panel DS1 BITS CLOCK connector. This LED flashes if the BITS clock input frequency is out of tolerance or is missing. When the DS1 BITS CLK LED is flashing the T BERD 310 transmits the SONET signal using internal timing.

PAYLOAD — The PAYLOAD setting is not user-selectable, but is forced whenever a DS1 bit-synchronous or DS1 byte-synchronous payload is inserted into the SONET signal. The original user setting is restored whenever payload timing is no longer forced.

In terminal mode, an ATM (3c), CONCAT (3c), 2^23-1 (3c), I2^23-1 (3c), ATM(12c), CONCAT (12c), 2^23-1 (12c), I2^23-1(12c), CONCAT (48c), 2^23-1 (48c), I2^23-1(48c), 2^31-1 (48c), I2^31-1(48c), DS3, DS1 payload is inserted into the SONET transmit signal. The drop function operates in either thru or terminal mode. The payload is always dropped or inserted into the current STS, as specified in section 2.3 (SONET Operating Modes) unless it is concatenated. The valid payloads for STM Modes are only concatenated payloads. For example, at STM-16, the valid payloads are CONCAT(48c), 2^23-1(48c), I23^23-1(48c), 2^31-1(48c), I2^31-1(48c).

Drop and insert of VT mappings is supported in floating mode only. Additionally, only the VT1.5 mapping is supported.

The payload position can be specified individually for the transmit and receive sides (i.e. insert DS1 4,1 and drop DS1 5,1). This is consistent with the operation of the T-BERD 310 DS1 drop and insert from DS3 and I allows the T-BERD 310 to be used to test routing of DS1s and DS3s through a SONET cross connect.

Inserting an ATM (3c), CONCAT (3c), 2^23-1 (3c), I2^23-1 (3c), ATM(12c), CONCAT (12c), 2^23-1 (12c), I2^23-1(12c), CONCAT (48c), 2^23- 1 (48c), I2^23-1(48c), 2^31-1 (48c), I2^31-1(48c), DS3 or DS1 Payload is supported. Either the T-BERD 310's DS1 or the DS3 transmit output is mapped into any of the supported SONET signal rates and transmitted. The mapping functionality is similar to that which is provided at the DS3 Demux level as described below:

DS3 or DS3 ATM to STS-N or OC-N — The user can insert an internal or an external DS3 signal into a single STS-1 of an STS-N signal, or all STS-1's of an STS-N signal.

DS1 to STS-N or OC-N — The user can insert an internal or an external DS1 signal into a single DS1 channel mapping or all DS1 channels of the current STS-1 or all DS1 channels in all STS-1s in the transmitted OC-N signal.

CONCAT (3c), and PRBS to OC-12 or OC-48 — The user can insert an internal OC-3c payload into an OC-12 or OC-48 signal.

CONCAT (12c), and PRBS, to OC-48 — The user can insert an internal OC-12c payload into an OC-48 signal.

ATM (3c) to OC-12 or OC-48 — The user can insert an internal ATM (3c) payload into an OC-12 or OC-48 signal.

ATM (12c) to OC-48 — The user can insert an internal ATM OC-12c payload into an OC-48 signal.

CONCAT (48c) PRBS — The user can select CONCAT (48c) as an OC-48 "payload".

To drop an ATM (3c), CONCAT (3c), 2^23-1 (3c), I2^23-1 (3c), ATM(12c), CONCAT (12c), 2^23-1 (12c), I2^23 1(12c), CONCAT (48c), 2^23-1 (48c), I2^23-1(48c),, 2^31-1 (48c), I2^31-1 (48c),, DS3 or DS1 payload, do the following:

On the drop side, the currently selected ATM (3c), CONCAT (3c), 2^23-1 (3c), I2^23-1 (3c), ATM(12c), CONCAT (12c), 2^23 1 (12c), I2^23-1(12c), CONCAT (48c), 2^23 1 48c , I2^23-1 48c , 2^31-1 (48c), I2^31-1(48c), DS3 or DS1 payload, is extracted from the received SONET. The type of drop payload may be explicitly specified or the test set can AUTO to the proper payload.

2.31.7 AUX Switch [7]

Depending on the installed SONET options, SONET RX and/or SONET TX auxiliary groups are added to the T-BERD 310. Refer to Section 2.67 and Section 2.68 for more information on the SONET option auxiliary functions.

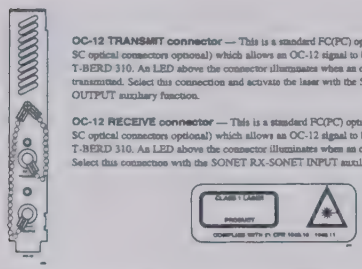
2.32 TEST CONNECTIONS

The SONET options add connections for electrical and optical SONET signals operating at STS-1, OC-1, OC-3, OC-12, and OC-48; access to the Line and Section orderwire and DCC channels; and an input for a DS1 BITS clock. The available connections are described by option. In addition to these connections, the T-BERD 310 and DS1/DS0 Analyzer Option connections are also described that allow DS3 and DS1 payloads to be dropped and inserted into and out of a SONET signal.

2.32.1 SONET Connections

Figure 2-16 to Figure 2-22 show the SONET Transmit/Receive Option side-panel connections. The signal rate can be configured separately for the receiver and transmitter. The connectors for the SONET transmitter are disabled if they are not used to generate the rate currently configured. For example, the OC-12 output is disabled when not generating OC-12. This is done to ensure that no optical transmitter is turned on without the user explicitly requesting it.

Figure 2-16 describes the 310-12 SONET OC-12 Receive/Transmit Option side-panel connections.



OC-12 TRANSMIT connector — This is a standard FC(PC) optical connector (ST® and SC optical connectors optional) which allows an OC-12 signal to be transmitted from the T-BERD 310. An LED above the connector illuminates when an optical signal is being transmitted. Select this connection and activate the laser with the SONET TX-SONET OUTPUT auxiliary function.

OC-12 RECEIVE connector — This is a standard FC(PC) optical connector (ST® and SC optical connectors optional) which allows an OC-12 signal to be connected to the T-BERD 310. An LED above the connector illuminates when an optical signal is received. Select this connection with the SONET RX-SONET INPUT auxiliary function.

Figure 2-16. 310-12 SONET OC-12, OC-12c Transmit/Receive Option Connections

Figure 2-17 describes the 310-13R SONET STS-1 Receive Option side-panel connections.

STS-1 RECEIVE connector — This is a standard WECO 560A connector (BNC optional) which allows an STS-1 signal to be connected to the T-BERD 310. Set input level with the SONET RX-STS RX LEVEL auxiliary function.

DCC DROP INSERT connector — This is a 15-pin, D-type female connector which allows the SONET DCC to be dropped and inserted (310-13T required) through the T-BERD 310. Select either Line or Section DCC access with the SONET RX-SONET DCC auxiliary function.

Figure 2-17. 310-13R SONET STS-1 Receive Option Connections

Figure 2-18 describes the 310-13T SONET STS-1 Transmit Option side-panel connections.

STS-1 TRANSMIT connector — This is a standard WECO 560A connector (BNC optional) which allows an STS-1 signal to be transmitted from the T-BERD 310. Set output level with the SONET TX-STS TX LEVEL auxiliary function.

DS1 BITS CLOCK connector — This is a bantam connector which allows a DS1 BITS clock to be used as an external SONET transmit timing source, or for DS1 timing slip testing. Set input termination with the MISC-DS1 BITS CLK auxiliary function. Select connection through the SONET TX-SONET TIMING auxiliary function when used as an external SONET transmit timing source. Select connection through the AUX-SLIP REF auxiliary function for DS1 timing slip testing.

HANDSET connector — This is an RJ-11 connector which allows access to the SONET orderwire channel. Select either the Line or Section orderwire channel with the SONET TX-ORDERWIRE auxiliary function.

Figure 2-18. 310-13T SONET STS-1 Transmit Option Connections

Figure 2-19 describes the 310-14R SONET STS-1, OC-1/3/3c Receive Option side-panel connections.

STS-1 RECEIVE connector — This is a standard WECO 560A connector (BNC optional) which allows an STS-1 signal to be connected to the T-BERD 310. Set input level with the SONET RX-STS RX LEVEL auxiliary function.

OC-1/OC-3 RECEIVE connector — This is a standard FC(PC) optical connector (ST® and SC optical connectors optional) which allows either an OC-1/3/3c signal to be connected to the T-BERD 310. An LED above the connector illuminates when an optical signal is received. Select this connection with the SONET RX-SONET INPUT auxiliary function.

DCC DROP INSERT connector — This is a 15-pin, D-type female connector which allows the SONET DCC to be dropped and inserted (310-13T required) through the T-BERD 310. Select either the Line or Section DCC access with the SONET RX-SONET DCC auxiliary function.

Figure 2-19. 310-14R SONET STS-1, OC-1/3/3c Receive Option Connections

Figure 2-20 describes the 310-14T SONET STS-1, OC-1/3/3c Transmit Option side-panel connections.

STS-1 TRANSMIT connector — This is a standard WECO 560A connector (BNC optional) which allows an STS-1 signal to be transmitted from the T-BERD 310. Set output level with the SONET TX-STS TX LEVEL auxiliary function.

OC-1/OC-3 TRANSMIT connector — This is a standard FC(PC) optical connector (ST® and SC optical connectors optional) which allows either an OC-1/3/3c signal to be transmitted from the T-BERD 310. An LED above the connector illuminates when an optical signal is being transmitted. Select this connection and activate the laser with the SONET TX-SONET OUTPUT auxiliary function.

DS1 BITS CLOCK connector – This is a bantam connector which allows a DS1 BITS clock to be used as an external SONET transmit timing source, or for DS1 timing slip testing. Set input termination with the MISC-DS1 BITS CLK auxiliary function. Select connection through the SONET TX-SONET TIMING auxiliary function when used as an external SONET transmit timing source. Select connection through the AUX-SLIP REF auxiliary function for DS1 timing slip testing.

HANDSET connector — This is an RJ-11 connector which allows access to the SONET orderwire channel. Select either the Line or Section orderwire channel with the SONET TX-ORDERWIRE auxiliary function.

Figure 2-20. 310-14T SONET STS-1, OC-1/3/3c Transmit Option Connections

Signal Loss — Indicates no SONET pulse signals present. When the signal is acquired again, the LED goes out, and the associated History and Signal Present LEDs illuminate.

Frame Loss — Indicates loss of frame synchronization. When synchronization is acquired again, the LED goes out, and the associated History and Frame Sync LEDs illuminate.

Section BIP — Flashes on for 100 milliseconds whenever a section Bit Interleaved Parity (BIP) error occurs. When the Section BIP LED goes out, the associated History LED illuminates and until a restart or history reset is initiated.

Line AIS — Line alarm indication signal (AIS) alarm is declared after detecting a 111 pattern in the Line overhead APS byte (K2), Bits 6 to 8, for five consecutive frames. Line AIS is removed after detecting a pattern other than 111 in Bits 6-8 of byte K2 for five consecutive frames. Line AIS indicates to downstream equipment that an upstream section terminating equipment (STE) has detected loss of signal or loss of framing.

Line RDI — Line remote defect indication (RDI) alarm (also known as far-end receive fail (FERF) alarm) is declared after detecting a 110 pattern in the Line overhead APS byte (K2), Bits 6 to 8, for five consecutive frames. Line RDI is removed after detecting a pattern other than 110 in Bits 6-8 of byte K2 for five consecutive frames. Line RDI alerts an upstream device of a downstream failure, such as loss of signal, loss of frame, or Line AIS.

Line BIP — Flashes on for 100 milliseconds whenever a line Bit Interleaved Parity (BIP) error occurs. When the Line BIP LED goes out, the associated History LED lights and stay lit until a Restart or History Reset is initiated.

Path AIS — Path AIS alarm is declared after detecting an all ones pattern in the Line overhead pointer bytes (H1 and H2) for three consecutive frames. Path AIS is removed when a valid set of pointer bytes and active new data flags (NDFs) are received, or when a valid pointer value is observed in three consecutive frames. Path AIS alerts the downstream path terminating equipment (PTE) that an upstream failure has occurred.

Path LOP — Path loss of pointer (LOP) alarm is declared when a valid pointer value cannot be determined from the Line overhead pointer bytes (H1 and H2). Specifically, Path LOP is declared if a valid pointer is not found in eight consecutive frames, if eight consecutive active NDFs are received without the corresponding concatenation indication. The Path LOP alarm is removed when a consistent pointer value or concatenation indication is received for three consecutive frames.

Path RDI —Path RDI alarm (also known as RAI or Yellow Alarm) is declared after detecting a one in Bit 5 of the Path status byte (G1) for five consecutive frames. STS Path RDI is removed after Bit 5 of byte G1 contains a zero for five consecutive frames. Path RDI indicates to the upstream PTE that a downstream failure has been detected.

Path BIP — Flashes on for 100 milliseconds whenever a path Bit Interleaved Parity (BIP) error occurs. When the Path BIP LED goes out, the associated History LED lights and stays lit until a Restart or History Reset is initiated.

VT AIS — VT AIS alarm is declared after detecting an all ones pattern in the VT pointer bytes (V1 and V2) for three consecutive VT superframes. VT Path AIS is removed under two conditions: when a valid VT pointer, valid VT size, and the NDF 1001 flag are detected, or three consecutive VT superframes containing a valid VT pointer, valid VT size, and a normal NDF are detected. VT AIS alerts the downstream VT PTE of an upstream failure.

VT LOP — VT LOP alarm is declared when a valid pointer value cannot be determined from the VT Path overhead bytes (V1 and V2). Specifically, VT Path LOP is declared if a valid pointer is not found in eight consecutive frames, if eight consecutive active NDFs are received without the corresponding concatenation indication. The VT Path LOP alarm is removed when a consistent pointer value or concatenation indication is received for three consecutive frames.

VT RDI — VT RDI alarm (also known as RAI or Yellow Alarm) is declared after detecting a one in Bit 8 of the VT Path overhead byte (V5) for five consecutive VT superframes. The VT Path RDI alarm is removed when a zero is detected in Bit 8 of byte V5 for five consecutive frames. VT RDI indicates to the upstream VT PTE that a downstream failure has been detected.

VT BIP — Flashes on for 100 milliseconds whenever a virtual tributary Bit Interleaved Parity (VT BIP) error occurs. When the Line BIP LED goes out, the associated History LED lights and stays lit until a Restart or History Reset is initiated.

Path PTR Adjust — Flashes on for 100 milliseconds whenever a change in the STS path pointer value occurs. When this goes out, the associated History LED lights and stays lit until a Restart or History Reset is initiated.

VT PTR Adjust — Flashes on for 100 milliseconds whenever a change in the virtual tributary (VT) path pointer value occurs. When this goes out, the associated History LED lights and stay lit until a Restart or History Reset is initiated.

2.33.3 SUMMARY Category Messages

During initial acquisition of the received SONET signal, the SUMMARY category should be displayed. This provides key section, line, and path results on the received SONET signal. When an error is detected, the appropriate result appears in the displayed SUMMARY category.

Additional SONET alarms also appear as messages in the SUMMARY category. To provide both current and history indications, an "H" and/or "C" appears at the right side of the window. The alarms apply to the selected SONET signal being received. The VT-related alarms apply to the selected DS1 channel. The SONET alarms appear as follows in the SONET Alarm result. The following example indicates current *and* past Line AIS conditions, as well as DS3 Bit Errors.

```
SONET Alarm:      BIT ERRORS
LINE AIS  HC        2323323
```

SEF — Severely Errored Frame alarm is declared when four consecutive STS-N frames are received with frame word errors.

LOS — Loss of Signal is declared when either the STS-1 or OC-n signal is lost.

LOF — Loss of Frame alarm is declared when an SEF condition exists for 3 ms or a random unframed signal is detected for 625 µs. Loss of frame is removed when two consecutive error-free frames are detected.

2.34 STARTING AND RUNNING THE TEST

2.34.1 Inserting SONET Errors

The SONET transmitter option must be installed in order to perform SONET error insertion. Otherwise, none of the error types can be selected. Errors may be inserted one type at a time through **ERROR INSERT** switch and **INSERT** switch.

2.34.1.1 ERROR INSERT Selection Switch

The **ERROR INSERT Selection** switch selects an error type. The selected error type is indicated by an illuminated yellow LED.

2.34.1.2 INSERT Switch

Pressing and releasing the **INSERT** switch inserts a one-time single error of the selected type, and the switch flashes briefly.

NOTE

For SONET FRAME error insertion the switch flashes once for each frame inserted, as specified in the SONET TX-SONET ERR RT auxiliary function.

Pressing the **INSERT** switch for more than 1 second inserts errors at the rate specified in the SONET TX-SONET ERR RT auxiliary function. The switch remains illuminated and the error insertion continues until the switch is pressed again.

NOTE

For SONET FRAME errors, continuous frame errors are inserted until the switch is pressed again.

2.34.1.3 Inserting Errors

The **ERROR INSERT Selection** switch can select from the following error types.

SONET FRAME — Selects frame word for error insertion.

SECTION BIP — Selects section BIP error type for insertion.

NOTE

If a Line AIS is being transmitted, the Line Error Insert selection is inactive. Additionally, if the test is set is in THRU mode, only the Line BIP error insert is active.

LINE BIP — Selects line BIP error type for insertion.

LINE FEBE — Selects line FEBE error type for insertion.

NOTE

If a Path AIS or Line AIS is being transmitted, the Path error insert is inactive.

PATH BIP — Selects path BIP error type for insertion in the selected STS ID.

PATH FEBE — Selects path FEBE error type for insertion in the selected STS ID.

NOTE

VT error insert is inactive if an AIS condition is being transmitted, or the test set is in THRU mode

VT BIP — Selects VT BIP error type for insertion in the selected STS ID and DS1 channel.

VT FEBE — Selects VT FEBE for insertion in the selected STS ID and DS1 channel.

2.34.2 ALARM INSERT Switches

SONET alarms may be selected and generated one type at a time through the **ALARM INSERT Selection** switch and **INSERT** switch. SONET alarms cannot be transmitted in the SONET THRU mode. The **ALARM INSERT** switch selects error types one at a time. The selected error type is indicated by an illuminated yellow LED. Pressing and releasing the **INSERT** switch inserts an alarm of the selected type; the switch remains illuminated until pressed again.

NOTE

If the **ALARM INSERT Selection** switch is used to scroll through Alarm LEDs while an alarm is being transmitted, alarm generation ceases and the **INSERT** switch goes out.

2.34.2.1 Forced Alarm Conditions

When present, "forced alarm" conditions must be cleared before new alarms can be selected and inserted. When these "forced" alarms are present the LED for the alarm illuminates, and the **INSERT** switch also illuminates. However, both the rocker switch and the INSERT button are disabled until the existing alarm is cleared. The forced alarm conditions are described as follows:

LINE AIS in SONET THRU mode — This alarm is "forced" in SONET THRU MODE when the receiver loses SONET FRAME SYNC.

PATH AIS in DS3 ASYNC EXT mode — This alarm is "forced" when the SONET INSERT selection is set to DS3 ASYNC EXT and the external DS3 signal is not present.

VT AIS in DS1 ASYNC EXT, DS1 BIT EXT, or DS1 BYTE EXT modes — This alarm is "forced" when the SONET INSERT selection is set to either DS1 ASYNC EXT, DS1 BIT EXT, or DS1 BYTE EXT, and the external DS1 signal is not present.

VT AIS in DS1 BYTE EXT DS1 BYTE INT modes — This alarm is "forced" if frame synchronization does not exist on the DS1 signal.

2.34.2.2 Alarm Types

Use the **ALARM INSERT Selection** switch to select the following alarm types.

LINE AIS — Inserts a Line AIS alarm. The Line AIS indicates to downstream equipment that upstream STE has detected a loss of signal or loss of framing. This alarm is transmitted in the transport overhead.

LINE RDI — Inserts a Line RDI alarm. The Line RDI (also known as far-end receive fail (FERF) alarm) is asserted by line terminating equipment (LTE) when loss of signal, loss of frame, or line AIS is detected on the incoming signal. This alarm is transmitted in the transport overhead.

PATH AIS — Inserts a Path AIS alarm. The Path AIS alerts the downstream STS PTE that an upstream failure has occurred. This alarm is transmitted in the selected STS.

PATH LOP — Inserts a Path LOP alarm. The STS Path LOP is declared when a valid STS pointer value cannot be obtained. In order to generate a Path LOP in the SONET transmission equipment, the T-BERD 310 invalidates the STS pointer bytes (H1, H2). This alarm is transmitted in the transport overhead of the selected STS.

PATH RDI — Inserts a Path RDI alarm (also known as RAI or Yellow Alarm). The Path RDI indicates to the upstream PTE that a downstream failure has been declared. This alarm is transmitted in the selected STS.

VT AIS — Inserts a VT AIS alarm. The VT AIS alerts the downstream VT PTE of an upstream failure. It is defined as an all ones pattern in the entire VT. The T-BERD 310 generates this alarm on the selected DS1 channel. This alarm is transmitted in the selected STS.

VT LOP — Inserts a VT LOP alarm. The VT LOP is declared when a valid VT pointer value cannot be obtained. In order to generate a VT LOP in the SONET transmission equipment, the T-BERD 310 invalidates the VT pointer bytes (V1, V2) on the selected DS1 channel. This alarm is transmitted in the selected STS.

VT RDI — Inserts a VT RDI alarm (also known as RAI or Yellow Alarm). The VT RDI indicates to the upstream VT PTE that a downstream failure has been declared. The T-BERD 310 generates this alarm on the selected DS1 channel. This alarm is transmitted in the selected STS.

2.35 COLLECTING TEST RESULTS

The SONET results are found in the SECTION, LINE, PATH, or VT results categories. The SUMMARY category displays key results that are non-zero or out-of-specification. When a SONET DS3 payload is dropped for analysis, the primary DS3 category results are also available. When a SONET DS1 payload is dropped for analysis, the DS1 signal can be analyzed from either the DS1/DS0 Analyzer Option or an external DS1 test set connected to the side-panel DS1 DROP connector.

ATM ANALYSIS OPTIONS (310-15, 310-17A, 310-20)

2.36 INTRODUCTION

This section describes the option configurations, instrument setup, auxiliary functions, and test results for the following T-BERD 310 ATM options.

310-15 OC-3c ATM Analysis Option — Allows the T-BERD 310 to generate and analyze OC-3c ATM payloads. Requires SONET 310-14/RT (OC-3), 310-12 (OC-12) or 310-21 (OC-48) Option.

310-17A DS1/DS3 ATM Analysis Option — Allows the T-BERD 310 to generate and analyze DS1 and/or DS3 ATM payloads. Requires both the 310-1 DS1/DS0 Analyzer Option and 310-9B Enhanced DS1 Testing Option for DS1 ATM testing.

310-20 OC-12c ATM Analysis Option — Allows the T-BERD 310 to generate and analyze OC-12c SONET and ATM payloads. Requires SONET 310-12 (OC-12) or 310-21 (OC-48) Option.

Unless otherwise indicated, the following features apply to all ATM options:

- Analyzes individual detailed measurements which may include HEC errors, dropped cells, out of sequence cells, mis-inserted cells, bandwidth utilization, PTI, and CLP values, percentage of cells with CLP = 1, and detection of AIS, FERF/RDI, and loopback cells.
- Analyzes overall ATM measurements which include HEC errors, idle bandwidth, bandwidth utilization, out of delineation seconds, and loss of delineation seconds.
- Delineates received ATM cells mapped into the DS1/DS3, OC-3c, and OC-12c payloads using HEC framing format. DS1/DS3 ATM payloads can also be delineated using PLCP framing.
- Descrambles/scrambles the received/transmitted 48-byte ATM cell payload.
- Detects ATM cells by user-defined VPI/VCI mask, cell header bit mask, or by cell content.
- Generates ATM compliant idle cells which fill unallocated payload bandwidth.
- Generates one primary ATM test cell channel and three ATM background channels within the DS1, DS3, OC-3c, or OC-12c payload envelope.
- Generates operations, administration, and maintenance (OAM) cells to control ATM-AIS and ATM-RDI alarms, and loopback cells for path integrity verification. The OAM cells can be configured for virtual path connection (VPC) and virtual channel connection (VCC) formats and defined for segment and end-to-end functions.
- Inserts correctable or non-correctable header error control (HEC) errors in all cells continuously, on individual cells, or at specific error rates.
- Stores four user-programmable ATM cells which enable any value to be entered into the generic flow control (GFC), virtual path identifier (VPI), virtual channel identifier (VCI), payload type identifier (PTI), and cell loss priority (CLP) fields in the ATM headers.
- Supports network node interface (NNI) and user-to-network interface (UNI) cell formats.

2.37 ATM SWITCH SELECTIONS

With an ATM option installed, one or more of the following switches are affected as indicated. The mainframe controls much of the setup and operation for testing ATM payloads. However, the DS1/DS0 Analyzer Option can also be used to test a DS1 ATM payload from a DS1, DS3, or SONET signal with the appropriate options installed. All ATM auxiliary functions are found on the mainframe (see Sections 2.69 and 2.70). All ATM test results are displayed through the mainframe ATM category (see Section 2.101).

The following ATM cell and payload test configuration setups are described in the indicated sections:

- DS1 ATM transmit to and analyze from DS1 ports (see Section 2.38.1)
- DS1 ATM analyze from DS3 ports (see Section 2.38.2)
- DS1 ATM transmit to and analyze from SONET ports (see Section 2.38.3)
- DS3 ATM transmit to and analyze from DS3 ports (see Section 2.39.1)
- DS3 ATM transmit to and analyze from SONET ports (see Section 2.39.2)
- SONET ATM transmit to and analyze from SONET ports (OC-3c or OC-12c) (see Section 2.40)

NOTE

In this section, mainframe switches are identified as "mainframe XXXXX switch" and 310-1 DS1/DS0 Analyzer Option switches are identified as "310-1 XXXX switch".

2.37.1 AUX Switch

To test ATM circuits, the T-BERD 310 is configured through the ATM RX (see Section 2.69) and ATM TX (see Section 2.70) auxiliary groups. Initial setup requires the ATM RX-RATE SELECT auxiliary function (see Section 2.69.2) be set to the correct data rate (DS1, DS3, OC-3c, or OC-12c) before configuring the rest of the T-BERD 310. The data rate determines which connections, auxiliary functions, and test results are available to test ATM payloads.

NOTE

The ATM RX-RATE SELECT auxiliary function only appears when more than one ATM option is installed (i.e., 310-15 OC-3c ATM Analysis Option, 310-17A DS1/DS3 ATM Analysis Option, and/or 310-20 OC-12c ATM Analysis Option). References to this auxiliary function, in the following sections, assumes the T-BERD 310 has multiple ATM options.

2.37.2 SETUP Switch

Use the **SETUP** switch to configure the modes, rates, patterns, and payloads for DS3, OC-3c, or OC-12c ATM testing as follows:

DS3 — Select to configure both DS3 transmitter and receiver operating modes and patterns for DS3 ATM testing.

SONET RX — Select to configure SONET receiver rates and payloads for OC-3c or OC-12c ATM testing.

SONET TX — Select to configure SONET transmitter rates and payloads for OC-3c or OC-12c ATM testing.

2.37.3 MODE/RATE Switch

To configure the mainframe for DS3, OC-3c, or OC-12c ATM testing, press the **MODE/RATE** switch to select the desired framing or rate as follows:

For DS3 ATM testing, select the desired DS3 framing: M13, C-BIT, or AUTO mode. When AUTO is selected as the DS3 mode and the **ATM RX-RATE SELECT** auxiliary function is set to DS3, the display indicates *atm (plcp)* for received PLCP formatted ATM signals, and *atm (hec)* for received HEC framed signals.

For OC-3c ATM testing, select either the OC-3, OC-12, or OC-48 mode.

For OC-12c ATM testing, select the OC-12 or OC-48 mode. While in OC-12c mode, selection of STS is not applicable.

2.37.4 PATTERN/PAYLOAD Switch

Use the **PATTERN/PAYLOAD** switch to select the appropriate ATM framing as follows:

For DS3 ATM testing, select one of the following DS3 ATM framing modes:

ATM (PLCP) — Configures the instrument to transmit and analyze ATM cells with Physical Layer Convergence Protocol (PLCP) framing format.

ATM (HEC) — Configures the instrument to transmit and analyze ATM cells with Header Error Correction (HEC) framing format.

ATM (OFF) — This only appears when the 310-15, 310-17A or 310-20 options are installed and the **ATM RX-RATE SELECT** auxiliary function is not set to DS3. DS3 ATM testing can not be performed when DS1, OC-3c or OC-12c ATM testing is performed. When **ATM (OFF)** appears under M13 or C-BIT framing, DS3 ATM test results are not available and the received DS3 signal is transmitted as the DS3 output. Only the DS3 overhead results are processed. The selection transmits 1111.

For OC-3c ATM testing, select one of the following OC-3c ATM framing modes:

ATM (3c) — OC-3c ATM signal to be transmitted and received.

ATM (3c-OFF) — This only appears when the 310-15, 310-17A, or 310-20 options are installed and the ATM RX-RATE SELECT auxiliary function is set to DS1, DS3, or OC-12c instead of OC-3c. OC-3c ATM testing cannot be performed when another rate of ATM testing is performed. When ATM (3c-OFF) appears under OC-3, OC-12 or OC-48, no OC-3c ATM test results are available.

AUTO — The T-BERD 310 automatically sets up the OC-3 receiver to the detected OC-3c ATM signal when AUTO is the selected OC-3 mode. When AUTO is selected as the OC-3c mode and the ATM RX-RATE SELECT auxiliary function set to OC-3c, the display indicates *(atm) (3c)* for received OC-3c ATM signals.

For OC-12c ATM testing, select one of the following OC-12c ATM framing modes:

ATM (12c) — OC-12c ATM signal to be transmitted and received.

CONCAT (12c) — Sets the T-BERD 310 to generate and receive a concatenated OC-12 signal. No test pattern is present in the payload of this concatenated signal.

ATM (12c-OFF) — This only appears when the 310-15, 310-17A, or 310-20 options are installed and the ATM RX-RATE SELECT auxiliary function is set to DS1, DS3, or OC-3c instead of OC-12c. OC-12c ATM testing cannot be performed when another rate testing is performed. When **ATM (12c-OFF)** appears under OC-12 or OC-48, no OC-12c ATM test results are available.

AUTO — The T-BERD 310 automatically sets up the OC-12 receiver to the detected OC-12c ATM signal when AUTO is the selected OC-12 mode. When ATM is selected for OC-12 via the ATM Rate Select auxiliary function, the T-BERD 310 displays *atm* for HEC framed signals.

2.37.5 310-1 MODE Switch

For DS1 ATM testing, the 310-1 **MODE** switch selects the desired DS1 framing: T1 D4, T1 ESF, T1 SLC, AUTO or SCAN.

If AUTO is selected, the DS1/DS0 Analyzer Option automatically configures the transmitter and receiver to the detected ATM framing, either HEC or PLCP. The instrument collects results and configures the DS1 transmitter to generate ATM signals according to the ATM TX auxiliary functions. When the ATM RX-RATE SELECT auxiliary function is not set to DS1, the DS1 AUTO function displays "live" for either PLCP or HEC framed DS1 ATM signals. When "live" is displayed, the T-BERD 310 does not provide DS1 ATM results, and it transmits the received DS1 signal as the DS1 output. The receiver processes DS1 overhead results only.

If SCAN is selected, the T-BERD 310 can recognize DS1 tributaries carrying ATM payloads. To further determine the type of ATM framing format (either HEC or PLCP), use the AUTO mode.

2.37.6 310-1 PATTERN Switch

For DS1 ATM testing, the 310-1 **PATTERN** switch selects one of the following DS1 ATM framing modes:

ATM (PLCP) — Configures the instrument to transmit and analyze ATM cells with Physical Layer Convergence Protocol (PLCP) framing format.

ATM (HEC) — Configures the instrument to transmit and analyze ATM cells with Header Error Correction (HEC) framing format.

ATM (OFF) — This only appears when the 310-15, 310-17A or 310-20 option is installed and the ATM RX-RATE SELECT auxiliary function is not set to DS1. DS1 ATM testing cannot be performed when DS3, OC-3c or OC-12c ATM testing is performed. When ATM (OFF) appears under T1 D4, T1 ESF or T1 SLC framing, no DS1 ATM test results are available and the received DS1 signal is transmitted as ALL ONES. Only the DS1 overhead results are processed.

2.38 INITIAL TEST SETUP FOR DS1 ATM TESTING

This section describes how the mainframe and 310-1 DS1/DS0 Analyzer Option are configured to test a DS1 ATM signal from DS1, DS3, OC-3, OC-12 or OC-48 payloads. The following switch selections provide DS1 ATM functionality to the 310-1 DS1/DS0 Analyzer Option when the 310-9B Enhanced DS1 Testing Option is also installed.

2.38.1 DS1 ATM Testing On a DS1 Signal

The following information describes how to configure the DS1/DS0 Analyzer Option to test a DS1 ATM payload on a DS1 signal. This allows both the DS1 ATM overhead bytes and payload to be tested using the mainframe, DS1/DS0 Analyzer Option, and 310-9B Enhanced DS1 Testing Option.

2.38.1.1 Analyzing a DS1 ATM Signal

To analyze a DS1 ATM payload from a received DS1 signal, set the following switches as indicated:

- Set the **DS1 SOURCE** switch to EXT. INPUT (DS1 RECEIVE connector).
- Set ATM RX-RATE SELECT auxiliary function to DS1.
- Set the **MODE** switch to AUTO.

2.38.1.2 Transmitting a DS1 ATM Signal

To transmit a DS1 ATM payload through a transmitted DS1 signal, set the following switches as indicated:

- Set the **TRANSMIT TIMING** switch to INTERNAL.
- Set the **CODE** switch to the desired DS1 coding.
- Set the **MODE** switch to the desired T1 framing: T1 D4, T1 SLC or T1 ESF.
- Set the **PATTERN** switch to the desired ATM framing: ATM (HEC) or ATM (PLCP).
- Set ATM RX-RATE SELECT auxiliary function to DS1.
- Use the ATM TX-PROFILE Pn auxiliary function to program the VPI/VCI address of the generated ATM cells.
- Use the ATM TX-TEST PROFILE auxiliary function to select a programmed profile to use as a test cell.
- Use the ATM TX-CELL BANDWDTH auxiliary function to select the % of ATM cells to contain the test cells and the % which contain background cells (all remaining cells are idle cells).

2.38.2 DS1 ATM Testing On a DS3 Signal

The following information describes how to configure the mainframe and DS1/DS0 Analyzer Option to test a DS1 ATM payload on a DS3 signal. This allows both the DS1 ATM overhead bytes and payload to be tested using the mainframe, DS1/DS0 Analyzer Option, and 310-9B Enhanced DS1 Testing Option.

2.38.2.1 Dropping a DS1 ATM Signal

To drop a DS1 ATM payload from a received DS3 signal, set the following switches as indicated:

- Set the mainframe **SETUP** switch to DS3 (DS3 RECEIVE connector).
- Set the mainframe **MODE/RATE** switch to AUTO.

- Set ATM RX-RATE SELECT auxiliary function to DS1.
- Set the mainframe **DS3-DS1 Channel Control-DROP** switch to the appropriate DS1 channel.
- Set the 310-1 **DS1 SOURCE** switch to DS3 DROP.
- Set the 310-1 **MODE** switch to AUTO.

2.38.3 DS1 ATM Testing On a SONET Signal

The following information describes how to configure the mainframe and DS1/DS0 Analyzer Option to test a DS1 ATM payload on a SONET signal. This allows both the DS1 ATM overhead bytes and payload to be tested using the mainframe, DS1/DS0 Analyzer Option, and 310-9B Enhanced DS1 Testing Option.

2.38.3.1 Dropping a DS1 ATM Signal

To analyze a DS1 ATM payload dropped from a SONET signal, set the following switches as indicated:

- Set the mainframe **SETUP** switch to SONET RX.
- Press the mainframe **MODE/RATE** switch to select the appropriate input connection: STS-1 (STS-1 RECEIVE connector), OC-1, OC-3 (OC1/3 RECEIVE connector), OC-12 (OC-12 RECEIVE connector), or OC-48 (OC-48 RECEIVE connector).
- Set the mainframe **PATTERN/PAYLOAD** switch to AUTO.
- Set the mainframe **SONET-VT Channel Control-DROP** switch to the appropriate DS1 channel dropped from the SONET signal.
- Set ATM RX-RATE SELECT auxiliary function to DS1.
- Set the 310-1 **DS1 SOURCE** switch to SONET DROP.
- Set the 310-1 **MODE** switch to AUTO.

2.38.3.2 Inserting a DS1 ATM Signal

Generate a DS1 ATM payload and insert it into a transmitted SONET signal, set the following switches as indicated:

- Set the mainframe **SETUP** switch to SONET TX.
- Use the mainframe **MODE/RATE** switch to select output connection: STS-1 (STS-1 TRANSMIT connector), OC-1, OC-3 (OC-1/3 TRANSMIT connector), OC-12 (OC-12 TRANSMIT connector), or OC-48 (OC-48 TRANSMIT connector).
- Set the mainframe **PATTERN/PAYLOAD** switch to DS1 ASYN INT.
- Set the mainframe **SONET-VT Channel Control-INSERT** switch to the appropriate DS1 ATM payload to be inserted into the SONET signal.
- Set ATM RX-RATE SELECT auxiliary function to DS1.
- Set the 310-1 **MODE** switch to the desired type of DS1 framing: T1 D4, T1 ESF or T1 SLC.
- Set the 310-1 **PATTERN** switch to the desired ATM framing: ATM (HEC) or ATM (PLCP).

2.39 INITIAL TEST SETUP FOR DS3 ATM TESTING

The following information describes how to configure the T-BERD 310 to drop and insert a DS3 ATM payload in a DS3, OC-3, OC-12, or OC-48 signal. This allows both the DS3 ATM overhead bytes and payload to be tested using the mainframe and 310-17A DS1/DS3 ATM Analysis Option.

2.39.1 DS3 ATM Testing On a DS3 Signal

The following information describes how to configure the mainframe to test a DS3 ATM payload on a DS3 signal.

2.39.1.1 Analyzing a DS3 ATM Signal

To analyze a DS3 ATM payload from a received DS3 signal, set the following switches as indicated:

- Set the **DS3 SOURCE** switch to DS3 (DS3 RECEIVE connector).
- Set the **SETUP** switch to DS3.
- Set ATM RX-RATE SELECT auxiliary function to DS3.
- Set the **MODE/RATE** switch to AUTO.

2.39.1.2 Transmitting a DS3 ATM Signal

To transmit a DS3 ATM payload through a transmitted DS3 signal, set the following switches as indicated:

- Set the **SETUP** switch to DS3.
- Set the **MODE/RATE** switch to the desired DS3 framing.
- Set the **PATTERN/PAYLOAD** switch to the desired ATM framing: ATM (HEC) or ATM (PLCP).
- Set ATM RX-RATE SELECT auxiliary function to DS3.
- Use the ATM TX-PROFILE Pn auxiliary function to program the VPI/VCI address of the generated ATM cells.
- Use the ATM TX-TEST PROFILE auxiliary function to select a programmed profile to use as a test cell.
- Use the ATM TX-CELL BANDWDTH auxiliary function to select the % of ATM cell to contain the test cells and the % which contain background cells (all remaining cells are idle cells).

2.39.2 DS3 ATM Testing On a SONET Signal

The following information describes how to configure the mainframe to test a DS3 ATM payload on a SONET signal.

2.39.2.1 Dropping a DS3 ATM Signal

To drop a DS3 ATM payload from a received SONET signal, set the following switches as indicated:

- Set the **DS3 SOURCE** switch to SONET
- Set the **SETUP** switch to SONET RX.
- Use the **MODE/RATE** switch to select STS-1 (STS-1 RECEIVE connector), OC-1, OC-3 (OC1/3 RECEIVE connector), OC-12 (OC-12 RECEIVE connector), or OC-48 (OC-48 RECEIVE connector) for the appropriate input connection.

- Set the **PATTERN/PAYLOAD** switch to AUTO.
- Set the **SETUP** switch to DS3.
- Set ATM RX-RATE SELECT auxiliary function to DS3.
- Set the **MODE/RATE** switch to AUTO.
- Select the DS3 to be dropped from the SONET signal using the **SONET-STS Channel Control-DROP** switch.

2.39.2.2 Inserting a DS3 ATM Signal

To transmit a DS3 ATM payload through a transmitted SONET signal, set the following switches as indicated:

- Set the **SETUP** switch to SONET TX.
- Set the **MODE/RATE** switch to select STS-1 (STS-1 TRANSMIT connector), OC-1, OC-3 (OC-1/3 TRANSMIT connector) OC-12 (OC-12 TRANSMIT connector) or OC-48 (OC-48 TRANSMIT connector).
- Set the **PATTERN/PAYLOAD** switch to DS3 ASYN INT.
- Set the **SETUP** switch to DS3.
- Set the **MODE/RATE** switch to select the desired DS3 framing.
- Set the **PATTERN/PAYLOAD** switch to the desired ATM framing, either ATM(HEC) and ATM(PLCP).
- Set ATM RX-RATE SELECT auxiliary function to DS3.
- Select the STS slot where the DS3 ATM signal is to be inserted by using the **SONET-STS Channel Control-INSERT** switch.
- Use the ATM TX-PROFILE Pn auxiliary function to program the VPI/VCI address of the generated ATM cells.
- Use the ATM TX-TEST PROFILE auxiliary function to select a programmed profile to use as a test cell.
- Use the ATM TX-CELL BANDWDTH auxiliary function to select the % of ATM cell to contain the test cells and the % which contain background cells (all remaining cells are idle cells).

2.40 INITIAL TEST SETUP FOR OC-3C OR OC-12C ATM TESTING

The following information describes how to configure the T-BERD 310 to drop and insert an OC-3c or OC-12c ATM payload through an OC-3, OC-12, or OC-48 signal. This allows both the OC-3c or OC-12c ATM overhead bytes and payload to be tested using the mainframe, 310-15 OC-3c ATM Analysis Option, and 310-20 OC-12c ATM Analysis Option.

2.40.1 Analyzing an OC-3c or OC-12c ATM Signal

To analyze an OC-3c or OC-12c ATM payload from a received SONET signal, set the following switches as indicated:

- Set the **SETUP** switch to SONET RX.
- Set ATM RX-RATE SELECT auxiliary function to OC-3c or OC-12c.
- Set the **MODE/RATE** switch to OC-3 (for OC-3c analysis), OC-12 (for OC-12c analysis), or OC-48 (for OC-48c analysis).

- Set the **PATTERN/PAYLOAD** switch to ATM (3c) for OC-3c analysis, ATM (12c) for OC-12c analysis, CONCAT(3c) for a concatenated OC-3c signal, CONCAT(12c) for a concatenated OC-12c signal, or AUTO to automatically detect and analyze either OC-3c or OC-12c, or OC-48 CONCAT(48c) for a concatenated OC-48c signal.

2.40.2 Generating an OC-3c or OC-12c ATM Signal

To transmit an OC-3c or OC-12c ATM payload through a transmitted OC-3c, OC-12c or OC-48 signal, set the following switches as indicated:

- Set the **SETUP** switch to SONET TX.
- Set ATM RX-RATE SELECT auxiliary function to OC-3c or OC-12c.
- Set the **MODE/RATE** switch to OC-3 (for OC-3c generation) or OC-12 (for OC-12c generation) or OC-48 (for OC-48c generation).
- Set the **PATTERN/PAYLOAD** switch to ATM (3c) for OC-3c generation, ATM (12c) for OC-12c generation, CONCAT(3c) for a concatenated OC-3c signal, or CONCAT(12c) for a concatenated OC-12c signal, or CONCAT(48c) for a concatenated OC-48c signal.

2.41 TEST CONNECTIONS

The T-BERD 310 can be connected to several different data rates to test ATM payloads. The following information describes the connections used in ATM testing.

DS1 ATM Testing — DS1 ATM testing through a DS1 signal is performed through the side-panel DS1 connections: DS1 RECEIVE and DS1 TRANSMIT.

DS3 ATM Testing — DS3 ATM testing through a DS3 signal is performed through the front-panel DS3 connections. DS3 RECEIVE and DS3 TRANSMIT

NOTE

If analyzing and/or generating either a DS1 or DS3 signal as the payload of a higher rate signal, then use the appropriate test connections.

OC-3c ATM Testing — OC-3c ATM testing is performed through the side-panel optical connections provided on the SONET option cards: OC-1/3, OC-12, and OC-48.

OC-12c ATM Testing — OC-12c ATM testing is performed through the side-panel optical connections provided on the SONET option cards: OC-12 and OC-48.

2.42 SIGNAL VERIFICATION

The initial ATM signal detection and synchronization is accomplished after the T-BERD 310 has synchronized with the received DS1, DS3, or SONET signal. The ATM Alarm test result appears in the SUMMARY category and the ATM Status test result appears in the ATM category. Status and alarms are indicated by green and red LEDs, respectively. Unless otherwise indicated, the following ATM Status and Alarm descriptions apply to all data rates.

2.42.1 ATM Status LEDs

ATM CELL SYNC — (Cell delineation/CD) This LED illuminates whenever 6 consecutive uncorrored HEC frames have been received. If cell synchronization loss occurs, the LED goes out and the Cell Sync Loss LED illuminates.

2.42.2 ATM Alarm LEDs

The ATM Alarm LEDs indicate the current (C) and historical (H) signal status for the following conditions (nn = C, H, or HC).

NOTE

ATM alarms are cleared any time the ATM RX-PROFILE Pn auxiliary function changes or a test restart occurs.

CELL SYNC LOSS — LED illuminates when ATM cell synchronization has been lost (7 consecutive uncorrectable HEC errors received). It remains illuminated through Cell Sync Loss and Cell Sync Fail, and until a test restart or cell synchronization re-occurs. The History LED illuminates after synchronization is reestablished.

NOTE

The ATM AIS and RDI alarms (below), and their associated History LEDs, are cell address-specific and only occur in relation to a specific profile or address. Therefore, upon changing the receive profile or cell address, these alarms and their associated History LEDs are reset.

ATM AIS — LED illuminates when an OAM Alarm Indication Signal cell has been received. The LED remains illuminated until a good cell, at the same address specified in the receive mask, has been received or after 3 seconds when no other OAM AIS cell has been received. For a profile that spans multiple addresses (using don't care values), the LED illuminates from the time an AIS OAM cell is received until no AIS OAM cells are received for any address for 3 seconds. The History LED illuminates when an AIS has occurred in the address specified in the receive mask, and remains illuminated until a restart or history reset occurs.

ATM RDI — LED illuminates when an OAM Remote Defect Indication cell has been received. The LED remains illuminated until a good cell, at the same address specified in the receive mask, has been received or after 3 seconds when no other OAM RDI cell has been received. For a profile that spans multiple addresses (using don't care values), the LED illuminates from the time an RDI OAM cell is received until no RDI OAM cells are received for any address for 3 seconds. The History LED illuminates when an RDI has occurred in the address specified in the receive mask, and remains illuminated until a restart or history reset occurs.

The following ATM Alarm test results (in the SUMMARY category) display current (C) and historical (H) signal status for the following conditions (nn = C, H, or HC).

ATM OCD (formally OUT OF SYNC) nn — Out of cell delineation (OCD) alarm indicates the reception of at least seven consecutive errored HECs after cell synchronization.

ATM LCD (formally SYNC LOSS) nn — Loss of cell delineation (LCD) alarm indicates continued loss of cell synchronization 4 ms after out of synchronization occurred.

ATM LCD FAIL (formally SYNC FAIL) nn — Loss of cell delineation failure (LCD FAIL) alarm indicates synchronization loss is present for 2.5 seconds. Cleared when cell synchronization is regained and loss of synchronization has not occurred in 10.0 seconds.

ATM NO MASKD nn — No Test Mask Cells Received alarm appears when no test mask cells are detected for more than 2 seconds after ATM cell synchronization. The status of the alarm is evaluated every 2 seconds.

ATM ALL IDLE nn — All Idle ATM Cells Received alarm appears when Idle ATM cells are detected for more than 2 seconds after ATM cell synchronization. The status of the alarm is evaluated every 2 seconds.

NOTE

The ATM alarms are cleared any time the ATM RX-PROFILE Pn auxiliary function changes or a test restart occurs.

The ATM Status test result displays current signal status for the following conditions as they occur:

CELL SYNC — Cell Synchronization
ATM OCD (formerly OUT OF SYNC) — Out of Cell Delineation
ATM LCD (formerly SYNC LOSS) — Loss of Cell Delineation
ATM LCD FAIL (formerly SYNC FAIL) — Loss of Cell Delineation Failure

2.43 STARTING AND RUNNING THE TEST

The following information is used to configure the T-BERD 310 to analyze ATM cells through inserting HEC or ATM alarm signals on the transmissions.

While transmitting an OC-12c signal, payload error and alarm insertion occurs across the entire OC-12c. Additionally, when transmitting an OC-12c signal, all STSs are examined for alarms and results accumulation. Restart events occur from the mainframe.

2.43.1 Inserting PLCP Errors

For DS1 or DS3 ATM testing, the T-BERD 310 is capable of inserting PLCP frame BIP-8 errors into any of the BIP-8 octet bits. PLCP BIP-8 errors are inserted with the ATM TX-PLCP ERR INS auxiliary function. The error rate is controlled through the ATM TX-PLCP ERR RT auxiliary function. In addition, the yellow alarm field of the PLCP frame is programmable between 0 (no alarm indication) and 1 (alarm indication).

2.43.2 Inserting ATM HEC Errors

The T-BERD 310 is capable of inserting HEC errors on cells. Errors are selectable as correctable. An "error event" is defined as the act of inserting one or more bit errors per header. The transmitter is capable of inserting error events on all cells (continuous), on individual cells (single), and at the following rates: 10^{-2} to 10^{-9}. Error rates are expressed as error events per cell, and are inserted.

Single error event insertion is restricted to the Test Cell Rate, Burst, and Continuous error event insertion covers all cells, and depending on the transmitted rate of the test cells, may not actually insert an error on any test cells. Error insertion is restricted to the 5-byte header of the ATM cell.

Select **ATM HEC** with the **ERROR INSERT Selection** switch to insert HEC error(s) into the ATM traffic being transmitted. Press the **INSERT** switch once to insert HEC error(s) according to the ATM TX-HEC ERR RATE auxiliary function. Press and hold the switch until the LED illuminates to insert HEC errors continuously at the rate currently selected by the ATM TX-HEC ERR RATE auxiliary function.

2.43.3 Inserting ATM Alarms

Select either the ATM AIS or ATM RDI LED with the **ALARM INSERT Selection** switch to insert OAM cells containing the appropriate alarm as follows:

ATM AIS — Press the **INSERT** switch to insert OAM cells containing an AIS alarm into the ATM traffic being transmitted.

ATM RDI — Press the **INSERT** switch to insert OAM cells containing an RDI alarm into the ATM traffic being transmitted.

The type and level of the alarm are set by the ATM TX-OAM INSERT and ATM TX-OAM FLOW auxiliary functions. Press the switch again or transmit another OAM cell type (e.g., RDI or LOOPBACK) to terminate the transmission.

NOTE

The **RESTART** switch allows the user to begin another test. When testing DS1 ATM signals, restarting tests can be initiate from either the mainframe or DS1/DS0 Analyzer Option. Restarting from the DS1/DS0 Analyzer Option *while DS1 ATM testing is active* re-initiates the test for *both* the mainframe and the DS1/DS0 Analyzer Option.

2.43.4 ATM SEARCH and PREVIEW Modes

There are two key ATM analysis modes featured in the T-BERD 310. These two modes are referred to as the SEARCH mode and PREVIEW mode. The two modes are initiated through the ATM RX-TEST MASK auxiliary function.

2.43.4.1 *Setting Up for ATM SEARCH Mode*

SEARCH mode allows the T-BERD 310 to search for three specific types of ATM cells in the incoming signal being analyzed: TTC cells, AIS cells, or RDI cells. At any given time, the user must select the type of ATM cell to be searched from these three cell types. When enabled, this feature prompts the T-BERD 310 to search for the selected cell type and show the VPI/VCI address of the first detected matching cell in the results display. The SEARCH mode may not be available for OC-12c ATM testing.

SEARCH mode can be used to isolate lost cells in an ATM network. The T-BERD 310 can generate a specialized TTC test cell, and can be configured to search for that cell and display the corresponding ATM address. This is useful since ATM switches positioned throughout the network can dynamically assign different addresses. Set up the SEARCH mode as follows:

1. Connect the T-BERD 310 to the network.
2. Enter the auxiliary functions.
3. Ensure the ATM RX-RATE SELECT auxiliary function is set to the proper rate (DS1, DS3, OC-3c or OC-12c) corresponding to the ATM rate being tested.

4. If test cells are generated with a T-BERD 310, then configure the ATM transmitter to generate cells at a specified bandwidth. The ATM transmitter can be set up through the ATM TX auxiliary group. Alternatively, if another TTC test instrument is used to generate test cells, configure it appropriately. If monitoring the network only, ignore this step.
5. Check the ATM LEDs for CELL SYNC.
6. Set the ATM RX-TEST MASK auxiliary function to either TTC SEARCH, AIS SEARCH, or RDI SEARCH, as appropriate.
7. Press the **RESTART** switch to initiate the search.
8. Press "USE" to save the VPI/VCI address found in the SRCH MASK when a matching cell has been found.
9. Select SRCH MASK to perform full analysis on the saved address.
10. Exit the auxiliary functions.

NOTE

Addresses that are shown in the results display indicate the address(es) that is carrying the original payload being transmitted by the T-BERD 310. If "— — —" appears, the searched cell is not found in the signal. The cells may be rerouted to a different signal port in the network.

To obtain ATM results on the cells with the desired VPI/VCI address, return to the ATM RX-TEST MASK auxiliary function and select SRCH MASK. If results on cells with other VPI/VCI addresses are desired, select TX TEST or P1-P4 as the test mask. This configures the ATM receiver to either analyze the addresses being generated by the T-BERD 310, or addresses that have been programmed into the receiver through the P1-P4 profile settings. If the receiver is left in SEARCH mode, the normal ATM results indicate "n/a" when the auxiliary function is exited.

2.43.4.2 Setting Up for ATM PREVIEW Mode

PREVIEW mode allows the T-BERD 310 to search and display the VPI/VCI address of incoming ATM cells as described below.

PREVIEW mode can be used to identify potential sources of congestion by analyzing active cells in an ATM network. The T-BERD 310 analyzes the entire signal payload, displaying active addresses, their bandwidths and cell type in one display window. Addresses that have an unusually high bandwidth usage can then be further tracked to isolate any problems. Set up the PREVIEW mode as follows:

1. Connect the T-BERD 310 to the network.
2. Enter the auxiliary functions.
3. Ensure the ATM RX-RATE SELECT auxiliary function is set to the proper rate (DS1, DS3, OC3c or OC-12c) corresponding to the ATM rate being tested.
4. Check the ATM LEDs for CELL SYNC.
5. Set the ATM RX-TEST MASK auxiliary function to PREVIEW.
6. Press the **RESTART** switch to initiate the search.
7. Select the ATM RX-PREVIEW auxiliary function to view bandwidth results on received cells.
8. Select P1-P4 as the test mask when full results analysis is desired.
9. Exit the auxiliary functions.

NOTE

Addresses shown in the results display indicate active address(es) in the network. If "— — —" appears, no active cells were found in the signal. For real-time bandwidth and cell type, use the ATM RX-PREVIEW auxiliary function.

To obtain ATM results on cells with a VPI/VCI address equal to the address of the found cell, return to the ATM RX-TEST MASK auxiliary function and select SRCH MASK. If results on cells with other VPI/VCI addresses are desired, select TX TEST or P1-P4 as the test mask. This configures the ATM receiver to either analyze the addresses being generated by the T-BERD 310, or addresses that have been programmed into the receiver through the P1-P4 profile settings. If the receiver is left in PREVIEW mode, the normal ATM results indicate "n/a" when the auxiliary function is exited.

2.44 COLLECTING TEST RESULTS

The ATM test results appear in the ATM and SUMMARY results categories of the mainframe. The displayed ATM test results pertain only to the rate selected in the ATM RX-RATE SELECT auxiliary function. The test results are unavailable if ATM cells have not been received. All ATM results are cleared by a test restart or by changing the ATM receiver configuration. Refer to Table 2-28 for a list of the available ATM test results and definitions found in the ATM results category.

OPTICAL MEDIA TEST OPTION (310-16)

2.45 INTRODUCTION

The 310-16 Optical Media Test Option provides optical physical layer testing by measuring optical power and return loss independent of the data rate. The card can be field installed and provides independent optical power meter and optical return loss/stable source side panel connections for the T-BERD 310. The option also provides dual wavelength (1310 and 1550 nm) measurements. Optional FC-, ST-, or SC-type fiber optic connectors can be ordered for the side panel connections.

The optical power meter test result appears as OPTICAL PWR and return loss measurement test result appears as RETURN LOSS in the SIGNAL category test results.

2.46 INITIAL TEST SETUP

Use the following information to configure the Optical Media Test Option to measure optical power from an optical source, measure optical return loss, or generate an optical source.

2.46.1 AUX Switch

The Optical Media Test Card is configured through the following auxiliary functions in the OPTICAL TEST auxiliary group. Press the **AUX** switch to display the auxiliary functions and press the **MODE** switch to select the auxiliary groups. Press the **PATTERN** switch to display the specified auxiliary functions. The auxiliary optical test functions are described in Section 2.71.

2.47 TEST CONNECTIONS

The Optical Media Test Option provides the following connections, shown in Figure 2-23, to measure optical power and return loss on fiber optic cable. When measuring the optical power, display the OPTICAL PWR test result in the DS3 SIGNAL category. When measuring the optical return loss on a fiber optic cable, display the RETURN LOSS test result in the DS3 SIGNAL category.

POWER METER connector — This is a standard FC(PC) optical connector which allows an optical source to be connected to the T-BERD 310 to measure optical power. Set input wavelength with the OPTICAL TEST-OPTICAL PWR auxiliary function.

RETURN LOSS/SOURCE connector — This is a standard FC(UPC) optical connector which allows return loss measurements to be performed while generating a stable continuous wave (CW) output source. A side-panel LED illuminates when the laser is transmitting. Select wavelength with the OPTICAL TEST-STABLE SOURCE auxiliary function. Set return loss measurement type with the OPTICAL TEST-RETURN LOSS auxiliary function.

Figure 2-23. Optical Media Test Option Connections

MANUFACTURING SOFTWARE OPTION (310-18)

2.48 INTRODUCTION

The 310-18 Manufacturing Software Option (formerly SONET Byte Manipulation Option) enables SONET overhead byte manipulation and optical SDH STM-1 test capabilities. The 310-18 Option requires the 310-14R and one of the 310-14T-1300 or 310-14T-Dual Options to be installed.

2.49 INITIAL TEST SETUP

Use the following information to configure the Manufacturing Software Option to manipulate or modify overhead byte information and test optical SDH STM-1 capabilities from an optical source. The synchronous digital hierarchy (SDH) STM-1 operating mode allows the T-BERD 310 to transmit and receive the optical STM-1 rate and payload. The following controls and auxiliary functions configure the T-BERD 310 for overhead byte and STM-1 testing. Refer to Section 2.30 for additional information.

2.50 TEST CONNECTIONS

SDH STM-1 signals are connected to the T-BERD 310 through the following side-panel connections: OC-1/OC-3 RECEIVE and OC-1/OC-3 TRANSMIT.

2.50.1 SETUP Switch

The **SETUP** switch is used to select the way mode and test pattern information is changed and displayed on the left-hand display. The switch selections include:

SONET RX — The T-BERD 310 can analyze a STM-1 payload dropped from an STS-1, OC-1, OC-3, OC-12, or OC-48 source. Set the **SETUP** switch to SONET RX and press the **RATE** switch to select STM-1 from the available input rates. To drop a STM-1 payload, select SONET RX from the **SETUP** switch, then use the **RATE** and **PAYLOAD** switches to configure the T-BERD 310 to drop the STM-1 payload from one of the following selections: AUTO, CONCAT (48c), CONCAT (12c), CONCAT (3c), 2^31-1 (48c), 2^23-1 (48c), 2^23-1 (12c), 2^23-1(3c), I2^31-1 (48c), I2^23-1 (48c), I2^23-1 (12c), I2^23-1 (3c), ATM (12c), or ATM (3c).

SONET TX — The T-BERD 310 can generate a STM-1 payload and insert it into either an OC-3, OC-12, or OC-48 signal. Select SONET TX using the **SETUP** switch, then use the **RATE** switch to select either OC-3 (OC-1/OC-3 TRANSMIT connector), OC-12 (OC-12 TRANSMIT connector), or OC-48 (OC-48 TRANSMIT connector). To insert an STM-1 payload, select SONET TX using the **SETUP** switch, then use the **RATE** and **PAYLOAD** switches to select **STM-1** from one of the following selections: CONCAT (48c), CONCAT (12c), CONCAT (3c), 2^31-1 (48c), 2^23-1 (48c), 2^23-1 (12c), 2^23-1 (3c), I2^31-1 (48c), I2^23-1 (48c), I2^23-1 (12c), I2^23-1 (3c), ATM (12c), or ATM (3c).

2.50.2 MODE/RATE Switch

Press the **MODE/RATE** switch to select either the SONET RX, or SONET TX for SDH STM-1 testing.

2.50.3 PATTERN/PAYLOAD Switch

Press the **PATTERN/PAYLOAD** switch to select one of the following SONET or STM-1 modes: AUTO, CONCAT (48c), CONCAT (12c), CONCAT (3c), 2^31-1 (48c), 2^23-1 (48c), 2^23-1 (12c), 2^23-1 (3c), I2^31-1(48c), I2^23-1 (48c), I2^23-1 (12c), I2^23-1 (3c), ATM (12c), or ATM (3c).

2.50.4 AUX Switch

To test SONET overhead byte information, the T-BERD 310 is configured through the following auxiliary groups. Press the **AUX** switch to display the auxiliary functions and press the **MODE** switch to select the auxiliary groups. Press the **PATTERN** switch to display the specified auxiliary functions.

2.50.4.1 SONET BYTES Auxiliary Group

The following is a brief summary of the SONET BYTES group auxiliary functions that are available. Refer to Section 2.69 for additional information on the auxiliary functions.

SECTION OVERHEAD BYTES — A1, A2, F1, D1, D2, and D3
LINE OVERHEAD BYTES — K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, Z1, and Z2
PATH OVERHEAD BYTES — C2, G1, F2, Z3, Z4, and Z5

The SONET BYTES auxiliary group supports the 27 additional auxiliary functions used to display/modify the TOH (Transmission Overhead) bytes in the SONET transmission stream. This auxiliary function allows the current status of the following bytes to be displayed and modified, if desired.

NOTE

The A1 and A2 byte displays n/a when OC-12 is the transmitter selection.

With the SONET BYTES auxiliary group selected, press the **PATTERN** switch to display the desired byte. Repeatedly pressing the **PATTERN** switch down arrow scrolls through the following series of bytes (top-to-bottom and left-to-right):

A1 BYTE	D5 BYTE	Z2 BYTE
A2 BYTE	D6 BYTE	C2 BYTE
F1 BYTE	D7 BYTE	G1 BYTE
D1 BYTE	D8 BYTE	F2 BYTE
D2 BYTE	D9 BYTE	Z3 BYTE
D3 BYTE	D10 BYTE	Z4 BYTE
K1 BYTE	D11 BYTE	Z5 BYTE
K2 BYTE	D12 BYTE	USER1 BYTE
D4 BYTE	Z1 BYTE	USER2 BYTE

With the USERn BYTE (n = 1 or 2) displayed, press the **RESULTS I Results** switch up arrow to move the cursor to the right or down arrow to move the cursor to the left to position it under the displayed value (in binary or Hex) of the transmit byte to be changed. Press the **RESULTS I Category** switch to change the value at the cursor position. The USERn BYTE value is the same for every byte that has the USERn BYTE selected. When the cursor is positioned under a binary value, pressing the **RESULTS I Category** switch toggles the binary value. However, when the cursor is positioned under the least significant Hex digit, pressing

the **RESULTS I Category** switch until the value rolls over (F to 0) the most significant digit increments to the next higher value. Similarly, pressing the **RESULTS I Category** switch until the value rolls over (0 to F) the most significant digit decrements to the next lower value. Press the **RESULTS II Results** switch to accept the displayed byte value. Changing the byte value keeps the modified value until the unit power is turned off. When power is turned on, the byte values return to their default values, listed as follows (in Hex).

A1 - F6
A2 - 28
C2 - 04 (varies, depending on the selected payload at start-up; e.g., 04 = DS3 Async Payload)
K2 - 04
All others - 00

When the Transmitter selection is THRU, all byte selections display **n/a**. The byte selection also displays **n/a** when any SONET alarm is inserted. After THRU mode and the alarm insert are disabled, the byte values return to their previous values.

2.51 SDH STM-1 SIGNAL VERIFICATION

STM-1 signal detection can be verified through the SONET Signal Present and Frame Sync Status LEDs, and SONET Signal Loss and Frame Loss Alarm LEDs. SONET Section, Line, and Path test results also identify the condition of the received signal.

The Line Overhead POINTER SIZE test result appears in the SUMMARY category if the pointer size bits of the incoming signal are set to any value other than 10 (i.e., POINTER SIZE = 00 for SONET).

INTERNAL MODEM OPTION (310-19)

2.52 INTRODUCTION

The 310-19 Internal Modem Option adds a full-duplex auto-answer internal modem to the T-BERD 310. The modem operates over a 2-wire dialup line at data rates up to 9600 b/s. Additional features include: AT command set compatible, built-in analog test capabilities, RJ-11 connection, and speaker (controlled from **VOLUME** control).

2.53 INITIAL TEST SETUP

The modem is selected through the PRINT-PORT auxiliary function (i.e., **MODEM**). The modem only functions when the auxiliary function is set to MODEM. Refer to Section 2.65 for more information describing the other PRINT auxiliary functions.

NOTE

The PRINT-PORT auxiliary function defaults to **MODEM** when the Internal Modem Option is installed and power is cycled.

2.54 TEST CONNECTIONS

The Internal Modem Option provides the following connections, shown in Figure 2-24, to connect the T-BERD 310 to a 2-wire dialup line.

2.55 SIGNAL VERIFICATION

The modem is configured as an auto-answer modem. When the modem receives the proper ringing and carrier detection, the modem answers the call and provides remote access to the T-BERD 310 through the TTC DTM software or other telecommunications package. The message *MODEM CONTROL* initially flashes on the display, then disappears, when the T-BERD 310 is under modem control. The **VOLUME** control can be adjusted to verify the ringing and carrier through the speaker.

LINE connector — RJ-11 2-wire connector used to connect the T-BERD 310 to the 2-wire dialup line.

CARRIER LED — Illuminates when carrier is detected.

RING LED — Flashes when ringing is detected.

Figure 2-24. Internal Modem Option Connections

DWDM CHANNEL MONITOR OPTION (310-22)

2.56 INTRODUCTION

The 310-22 DWDM Channel Monitor Option provides dense wavelength division multiplexing (DWDM) optical physical layer analysis. This option tests multiple signals over a single fiber optic cable as they pertain to channel signal-to-noise ratio, peak power, and center wavelength. Optional ST- or SC-type fiber optic connectors can be ordered for the side panel connections. The user accesses this option using a combination of AUX functions in WDM RX.

There are two operating modes for this option; Scan and Drop. In Scan mode, the DWDM module sweeps the 1528 nm thru 1565 nm spectrum searching for active DWDM channels. Channel activity is determined using the Peak Threshold and Peak Excursion parameters. In Drop mode, the operator has the opportunity to select a single channel from the side panel connector to be isolated and dropped.

DWDM test results are displayed on the T-BERD 310 mainframe in DS3 SIGNAL Results. (310-22 DWDM Channel Monitor Option required).

2.57 INITIAL TEST SETUP

Use the following procedure to configure DWDM Channel Monitor Option. The DWDM Channel Monitor Option is configured through the auxiliary functions in the T-BERD 310 AUX WDM RX auxiliary group.

2.58 TEST CONNECTIONS

The DWDM Channel Monitor Option provides the following connections, shown in Figure 2-25, to determine signal-to-noise ratio, center wavelength, and peak power on a single fiber optic cable.

CHANNEL OUTPUT connector — This is a standard FC (PC) optical connector which allows a specified wavelength from the DWDM spectrum to be filtered, transmitted to another T-BERD 310 board, and analyzed.

DWDM INPUT connector — This is a standard FC (UPC) optical connector which allows a DWDM source to be connected to the T-BERD 310 to analyze the DWDM spectrum

Figure 2-25. DWDM Test Option Connections (FC/ST)

2.58.1 AUX Switch

The DWDM Channel Monitor Option is configured through the auxiliary functions in the T-BERD 310 AUX WDM RX auxiliary group. Press the **AUX** switch to display the auxiliary functions and press the **MODE** switch to select the auxiliary groups. Press the **PATTERN** switch to display the specified auxiliary functions. The auxiliary optical test functions are described in Section 2.71.

2.58.2 MODE/RATE Switch

Press the **MODE/RATE** switch to select WDM RX.

2.58.3 PATTERN/PAYLOAD Switch

Press the **PATTERN/PAYLOAD** switch to select MODE, UNITS, CHANNEL, or PEAK. From the MODE selection, choose Scan or Drop. From the UNITS selection, choose nm or THz. From the CHANNEL selection, choose any applicable channel. From the PEAK selection, define the Peak Threshold and Peak Excursion parameters.

2.59 DWDM CHANNEL MONITOR GRAPHIC USER INTERFACE

The DWDM Channel Monitor Option contains a MS Windows® 95/98/NT software application program which retrieves DWDM measurements from the T-BERD-310 through an RS-232 interface and displays the measurements in table and graph format. The software can be used on a PC (and is particularly easy to operate via a laptop because it can be directly connected to a T-BERD 310 in the field), analyzing a network problem anywhere. When the software is installed (using installation diskettes), an icon is created on the desktop. Run the program by double clicking the icon.

2.59.1 Installing DWDM Channel Monitor Software

Use the following procedure to install DWDM Channel Monitor software onto a laptop computer.

1. Load setup diskette number 1 into the floppy disk drive. Follow instructions as prompted to sequential steps. When indicated, take out first diskette and insert diskette numbered 2 into the floppy disk drive. Complete installation by following prompts as they appear (click on "next" until "finished").
   - A DWDM Channel Monitor icon is created on the desktop (see Figure 2-26).

Figure 2-26. DWDM Channel Monitor Desktop Icon

2. Connect laptop to T-BERD 310 using an RS-232 cable. Set T-BERD 310 settings (after pressing **AUX** switch on test set) in the following order: baud rate, parity, terminator, and width (see Figure 2-27).

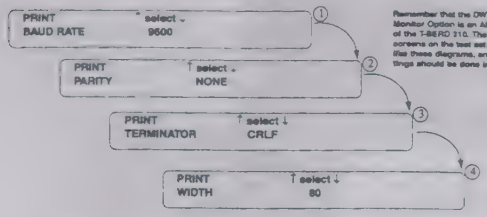


Figure 2-27. Property Settings on T-BERD 310 for Initializing DWDM Test

3. Double-click DWDM icon to run the program.
4. Verify connection. When program is launched on the laptop, it tries to connect automatically to the T-BERD 310. If the connection is successful, the LED above the **Scan Mode** property sheet (see Figure 2-29, callout #3) turns green; otherwise, it stays red. If red, check settings on laptop (click **Properties** icon above **Scan Mode** property sheet) to display CommPort Properties dialog box. It should look similar to Figure 2-28.

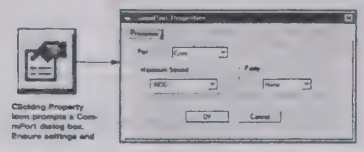


Figure 2-28. Property Settings on Laptop to Initialize DWDM Test

2.50.2 Using DWDM Channel Monitor Application

The program opens with the Scan Mode property sheet. Behind that screen is a second tab, the Terminal Mode property sheet. Figure 2-29 shows the opening screen. Descriptions of the callouts follow.

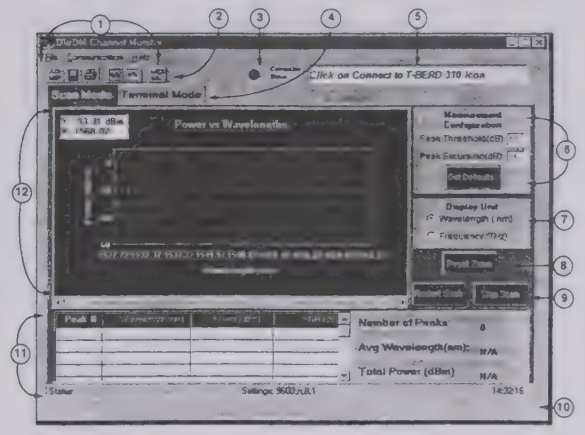


Figure 2-29. DWDM Channel Monitor Scan Mode Property Sheet

1. **Main Menu Bar** — This area displays the DWDM Channel Monitor main menu bar. The selections with pulldown menus and/or dialog boxes include:
   - **File** — Enables the user to:
     a. **Open Log File** — Displays a dialog box which allows the user to open a log file which was previously saved using the **Save To Log File** selection (see Figure 2-30). User can see a preview of the header information before opening the file. If accessed, stored data from the file is plotted on the Scan Mode tab in the Power vs. Wavelengths graph and Peak table.
     b. **Save To Log File** — Displays the same window as **Open Log File** selection. Here, the user can save the latest scan information onto a log file. Date and time of test, as well as configuration information is recorded into the log file. User also has an option to type in comments in the text box provided.
     c. **Print Chart** — Displays printer setup enabling user to choose a printer, number of copies, paper size, and paper orientation. ***Note:*** *The Graph and Table portion of the Scan Mode tab prints on separate pages.*
     d. **Exit** — Closes out of DWDM application program.

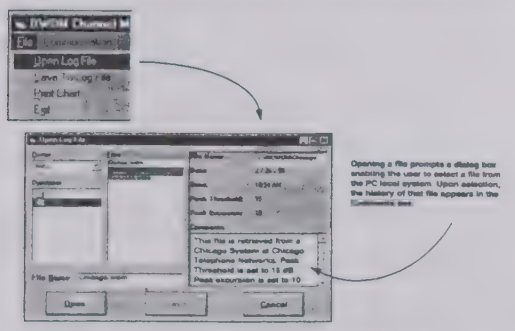

DWDM Channel
File
Open Log File
Save Log File
Print Chart
Exit
Opening a file prompts a dialog box enabling the user to select a file from the PC local system. Upon selection, the history of that file appears in the
Open
Cancel

Figure 2-30. DWDM Channel Monitor Open Log File Dialog Box

- **Communication** — Enables the user to:
  a. **Connect to 310** — Establishes serial communications between PC/laptop to T-BERD 310 via cabling. Scan Mode property sheet LED illuminates green (see Figure 2-31).

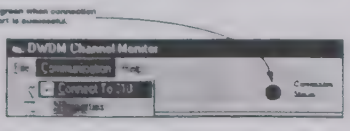


Figure 2-31. DWDM Channel Monitor Connects to T-BERD 310

  b. **Properties** — Establishes Com Port and baud rate choice when connecting to T-BERD 310.

2. **Icon Application Selection** — This area displays DWDM Channel Monitor icons under main menu bar (see Figure 2-32).

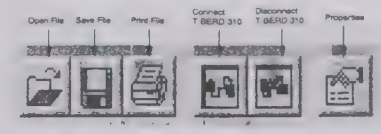


Figure 2-32. DWDM Channel Monitor Tool Bar Icons

a. **Open File icon** — Click to retrieve files from local system.
b. **Save File icon** — Click to save files to local system.
c. **Print File icon** — Click to save files to local system — after saving, then print.
d. **Connect T-BERD 310 icon** — Click to establish connection between PC and T-BERD 310 (via cabling).
e. **Disconnect T-BERD 310 icon** — Click to terminate connection between PC and T-BERD 310.
f. **Properties icon** — Click to establish port, speed, and parity when connecting T-BERD 310.

NOTE

The Menu Bar and Tool Bar controls are global controls that can be accessed from either the **Scan Mode** or **Terminal Mode** property sheet.

3. **LED** — Illuminates green when connected to T-BERD 310. If connection fails, it remains red.
4. **Tabbed Property Sheets** — There are two tabbed property sheets: **Scan Mode** and **Terminal Mode**. The **Scan Mode** tab contains command buttons, editing capabilities, and options. When the DWDM application opens, it opens to **Scan Mode**. All graphical and table measurements are done in this property sheet (see Figure 2-29). The **Terminal Mode** functions as a terminal simulation window. It enables the user to remotely control the T-BERD 310 by typing in remote control commands (see Figure 2-33).

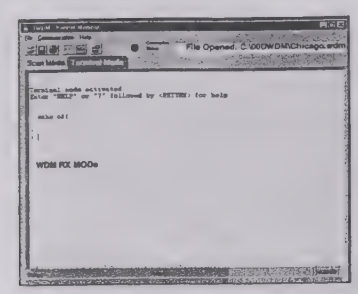

File Opened: C:\DWDM\Chicago.edm
Terminal mode activated
Enter "HELP" or "?" followed by <RETURN> for help
WDM FOX MODe
Note: In Terminal Mode, wait for the message "Terminal mode activated." before entering Remote Command.
Also, when returning to Scan Mode property sheet, click Restart Scan to re-engage DWDM Channel Monitor.

Figure 2-33. DWDM Channel Monitor Terminal Mode Property Sheet

5. **Scrolling Marquis** — Displays initialization of applications and displays log files opened from laptop (see Figure 2-29).
6. **Measurement Configuration Window** — Numerically displays measurements of Peak Threshold and Peak Excursion of wavelengths (nm) and frequency (THz) derived from channel activity (see Figure 2-29). The numbers are determined using Peak Threshold and Peak Excursion parameters. User can modify these values at any time. An error message box displays if values are not within normal range.
   - **Get Defaults:** Retrieves the default values of the measurement configuration and returns to a default parameter of 10 dB for Peak Threshold and 15 dB for Peak Excursion.
7. **Display Unit Window** — Indicates if optical spectrum measurements are to be displayed in either Wavelength (nm) or Frequency (THz) (see Figure 2-29).
8. **Reset Zoom:** Enables user to return to the original (full scan) graph (see Figure 2-29). When data is not in the process of being downloaded (**Stop Scan**), user can zoom into a specific range of the wavelengths by using the mouse button and dragging on the graph (creating a rubber band). When released, the selected wavelength range displays. Figure 2-34 shows the progression of changing screens when using the zoom function.

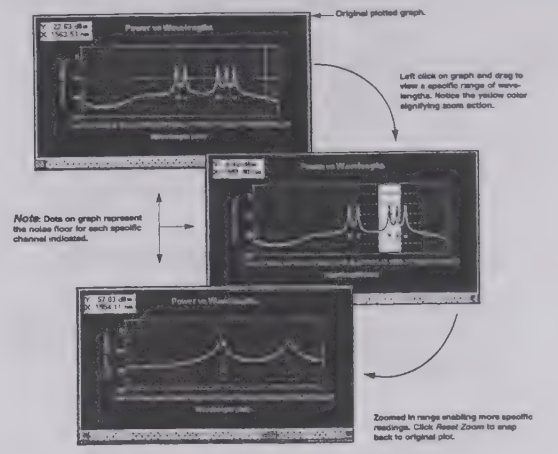

Original plotted graph.
Left click on graph and drag to view a specific range of wavelengths. Notice the yellow color signifying zoom action.
Note: Dots on graph represent the noise floor for each specific channel indicated.
Zoomed in range enabling more specific readings. Click Reset Zoom to snap back to original plot.

Figure 2-34. DWDM Scan Mode Zoom Capability

9. **Restart Scan / Stop Scan:** Press to get or set new criteria values (see Figure 2-29). Start the scan using configuration settings displayed in the **Measurement Configuration** window. The scan covers the full spectrum (1528 nm – 1565 nm) in searching for active DWDM channels. Once DWDM results are available, data is downloaded, and the graph is updated. This cycle is repeated until user presses **Stop Scan**.
10. **Status Bar** — This area identifies which file is open, settings, and time (see Figure 2-29).
11. **Number of Peaks Table** — This table displays information about the channels from the latest scan (see Figure 2-29). The number of rows are equal to the number of channels found from the scan. Each peak depicts wavelength, power, and SNR. The maximum number of channels the user can view at any given time is five; however, a scroll bar to the right of the table automatically displays when there are more than channels peaks found, and the user can use the down arrow to view more channels. A summary report of the measurements is listed on the right side of the table (see Figure 2-35).

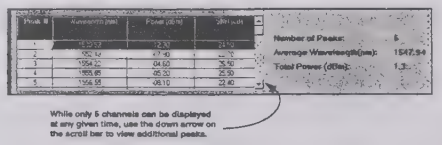

Number of Peaks: 5
Average Wavelength(nm): 1547.94
Total Power (dBm): 1.3...
While only 5 channels can be displayed at any given time, use the down arrow on the scroll bar to view additional peaks.

Figure 2-35. Number of Peaks Table within Scan Mode

12. **Power vs. Wavelength / Power vs. Frequency Graph** — This graph plots the points from every channel found in the latest scan (see Figure 2-34). Any point on the graph results in the X (wavelength/frequency) and Y (power) coordinates displaying a numerical figure in the text box located on the top left corner of the graph. Dots on grass represent the noise floor for each specific channel indicated. The graph automatically updates with every scan.
    - The user may also change the properties of the graph such as the X and Y axis scale, colors, and grids by right mouse clicking on the chart area (see Figure 2-36). A dialog box shows parameter choices.

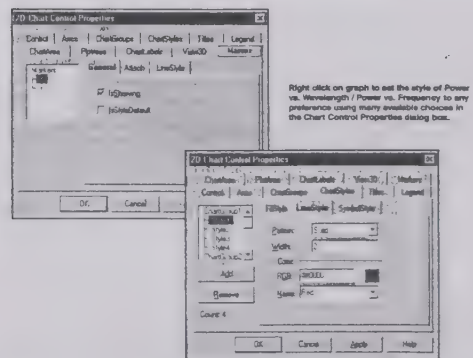

Right click on graph to set the style of Power vs. Wavelength / Power vs. Frequency to any preference using many available choices in the Chart Control Properties dialog box.
OK
Cancel
Apply
Help

Figure 2-36. Chart Control Properties Dialog Box Sets Graphical Style Preferences

2.60 INTRODUCTION

Auxiliary functions allow access to parameters that are not frequently used and do not have dedicated switches. Press the **AUX** switch to access the auxiliary functions. The auxiliary functions appear in all three display windows. The **MODE, PATTERN, RESULTS I,** and **RESULTS II** switches are used to manipulate the displayed auxiliary function as follows:

MODE switch — Press this switch to scroll through the auxiliary groups that appear in the MODE window.

PATTERN switch — Press this switch to scroll through the auxiliary functions of the selected auxiliary group. The auxiliary function name appears in the PATTERN window.

RESULTS I and RESULTS II switches — These switches are used in combination to change or enter information into the selected auxiliary function.

The T-BERD 310 mainframe auxiliary functions are divided into the following auxiliary groups:

ERR INSERT	DS3 Error Insertion Auxiliary Group
ERR RECEIVE	DS3 Received Signal Error Auxiliary Group
MUXED TX	Multiplexed Loop Code Auxiliary Group
TIME	Time and Date Auxiliary Group
PRINT	Printer/Remote Control Interface Auxiliary Group
MISC	Miscellaneous Auxiliary Group
SONET RX	SONET Receive Auxiliary Group (requires SONET options)
SONET TX	SONET Transmit Auxiliary Group (requires SONET options)
ATM RX	ATM Receive Auxiliary Group (requires an ATM Option)
ATM TX	ATM Transmit Auxiliary Group (requires an ATM Option)
OPTICAL TEST	Optical Test Auxiliary Group (requires the Optical Media Option)
JITTER	DS3 Jitter Auxiliary Group (requires DS3 Jitter Option)
SONET BYTES	SONET overhead byte modification Auxiliary Group (requires the Manufacturing Software Option)
WDM RX	DWDM Channel Monitor Auxiliary Group

2.61 ERR INSERT — DS3 ERROR INSERTION AUXILIARY GROUP

The ERR INSERT auxiliary group controls the DS3 logic, BPV, and frame error insertion capabilities of the **ERROR INSERT** switches. The following describes the ERR INSERT auxiliary group.

2.61.1 LOG/BPV RT — Logic and BPV Error Insertion Rate

ERR INSERT	↑ select ↓
LOG/BPV RT	1E-2

The ERR INSERT-LOG/BPV RT auxiliary function sets the logic error and BPV insertion rate when a burst of errors (see the ERR INSERT-LOG/BPV BUR auxiliary function) or continuous errors are inserted into the transmitted bit stream. Errors and violations are inserted with the **DS3 LOGIC** and **DS3 BPV ERROR INSERT** switches. Press the **RESULTS I Results** switch to select the error rate from 1E-2 to 1E-9.

2.61.2 FRAME ERROR — M-Frame Error Insertion Rate

ERR INSERT	↑ select ↓
FRAME ERROR	1/M-FRAME

The ERR INSERT-FRAME ERROR auxiliary function selects the number of consecutive frame errors (per M-frame) that are inserted into the transmitted framing pattern. The frame errors are inserted with the **DS3 FRAME ERROR INSERT** switch. Press the **RESULTS I Results** switch to select one or two frame errors per M-frame.

2.61.3 LOG/BPV BUR — Logic and BPV Error Insertion Burst Duration

ERR INSERT	↑ select ↓
LOG/BPV BUR	SINGLE

The ERR INSERT-LOG/BPV BUR auxiliary function sets the duration for logic error or BPV bursts when the **DS3 LOGIC** or **DS3 BPV ERROR INSERT** switch is pressed for less than 1 second. The ERR INSERT-LOG/BPV RT auxiliary function sets the error rate for the burst. Press the **RESULTS I Results** switch to select one of the following burst durations:

SINGLE — Inserts either a single logic error or BPV when the appropriate switch is pressed for less than 1 second.

25 ms to 1.0 second burst (in 25 ms steps) — Inserts a logic error or BPV burst from 25 ms to 1 second when the appropriate switch is pressed for less than 1 second.

1.0 to 5.0 seconds burst (in 100 ms steps) — Inserts a logic error or BPV burst from 1 to 5 seconds when the appropriate switch is pressed for less than 1 second.

2.62 ERR RECEIVE — DS3 RECEIVED SIGNAL ERROR AUXILIARY GROUP

The ERR RECEIVE auxiliary group controls the parity error rate calculation method, logic, BPV, and frame error rate threshold for the appropriate categories, and frame synchronization loss threshold. The ERR RECEIVE auxiliary group is described as follows:

2.62.1 PAR ERR RT — Parity Category Error Rate Calculation

ERR RECEIVE	↑ select ↓
PAR ERR RT	BIT ERROR

The ERR RECEIVE PAR ERR RT auxiliary function selects the parity error rate calculation method. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired calculation method.

BLOCK ERROR — The block error method is calculated as the ratio of the total number of parity errors to the total number of M-frames received.

BIT ERROR — The bit parity error rate is calculated as the ratio of the total number of parity errors to the total number of bits over which the parity was calculated (number of received M-frames multiplied by 4704). The bit parity error rate gives the best indication of the actual bit error rate.

2.62.2 FRM LOSS THR — Frame Synchronization Loss Threshold

ERR RECEIVE	↑ select ↓
FRM LOSS THR	3 OUT OF 15

The ERR RECEIVE-FRM LOSS THR auxiliary function determines when the T-BERD 310 loses frame synchronization. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired threshold.

3 OUT OF 15 — Frame synchronization is lost when 3 frame errors are counted in 15 received frame bits.

6 OUT OF 15 — Frame synchronization is lost when 6 frame errors are counted in 15 received frame bits.

2.62.3 ERROR THR — Logic, BPV, and Frame Errored Second Threshold

ERR RECEIVE	↑ select ↓
ERROR THR	1E-3

The ERR RECEIVE-ERROR THR auxiliary function selects the errored second thresholds for the BIT THR ES, FRM THR ES, and BPV THR ES results. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired error rate threshold from 1E-2 to 1E-7.

2.62.4 PAT LOSS THR — Pattern Loss Threshold

ERR RECEIVE	↑ select ↓
PAT LOSS THR	FAST

The ERR RECEIVE-PAT LOSS THR auxiliary function selects the criteria that determines when the T-BERD 310 loses pattern synchronization. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired threshold criteria:

FAST — Pattern synchronization is lost when 1024 or more bit errors are counted in 32,767 bits received.

SLOW — Pattern synchronization is lost when 250,000 or more bit errors are counted in 1,000,000 bits received.

2.63 MUXED TX — MULTIPLEXED LOOP CODE AUXILIARY GROUP

The MUXED TX auxiliary group controls the multiplexed DS3 output DS1 loop codes. The MUXED TX auxiliary group is described as follows:

2.63.1 DS1 LP CODE — DS1 Loop Code Select

MUXED TX	↑ select ↓
DS1 LP CODE	CSU

The MUXED TX-DS1 LP CODE auxiliary function selects the DS1 loop code for the MUXED M13 and MUXED C-BIT operating modes. The appropriate loop code is transmitted when the T1D4 LPDN, T1D4 LPUP, T1ESP LPDN, or T1ESP LPUP pattern is selected. The loop code is inserted with the **DS3-DS1 Channel Control-INSERT** switch. Press the **RESULTS I Results** switch to select the desired loop code from the following:

CSU — The Customer Service Unit loop codes allow the T-BERD 310 to establish a DS1 loopback with a compatible CSU. The transmitted loop-up code is 10000 and the loop-down code is 100.

FACILITY 1 — The 4-bit facility or network (or smart connector) loop codes allow the T-BERD 310 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 1100 and the loop-down code is 1110.

FACILITY 2 — The 5-bit facility or network (or smart connector) loop codes allow the T-BERD 310 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 11000 and the loop-down code is 11100.

PROGRAMMABLE — The 3- to 8-bit programmable loop codes allow the T-BERD 310 to establish a loopback with any nonstandard device. The loop codes are programmed through the MUXED TX-PGM LPUP and MUXED TX-PGM LPDN auxiliary functions.

2.63.2 PGM LPUP — Programmable Loop-Up Code

MUXED TX	↑forwrd rev↓	↑toggle end↓	
PGM LPUP	10000		

The MUXED TX-PGM LPUP auxiliary function programs a 3- to 8-bit user-defined loop-up code. This allows the T-BERD 310 to transmit nonstandard loop codes. The programmed loop-up code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4 LPUP or T1ESF LPUP pattern are selected. The MUXED TX-DS1 LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The MUXED TX-PGM LPUP auxiliary function is controlled by the following switches:

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

2.63.3 PGM LPDN — Programmable Loop-Down Code

MUXED TX	↑forwrd rev↓	↑toggle end↓	
PGM LPDN	100		

The MUXED TX-PGM LPDN auxiliary function programs a 3- to 8-bit user-defined loop-down code. This allows the T-BERD 310 to transmit nonstandard loop codes. The programmed loop-down code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4 LPDN or T1ESF LPDN pattern are selected. The MUXED TX-DS1 LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The MUXED TX-PGM LPDN auxiliary function is controlled by the following switches:

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

2.64.4 TEST — Set Test Duration Type

TIME	↑ select ↓	
TEST	CONTINUOUS	

The TIME-TEST auxiliary function sets the duration of the test being performed. Changing from TIMED to CONTINUOUS does not cause a test restart, but changing from CONTINUOUS to TIMED does.

CONTINUOUS — This allows continuous testing. The TIME category ELAPSED TIME result indicates the elapsed time from the test restart. The test results indicate accumulative counts since the test restart.

TIMED — This allows timed testing. The timed test length is set through the TIME-TEST LENGTH auxiliary function. At the end of a timed test, the results and the state of the Status and Alarm LEDs are frozen. A test results printout is generated at the end of the timed test when the PRINT-PRINT EVENT auxiliary function is set to any position, except OFF.

2.65 PRINT — PRINTER/REMOTE CONTROL INTERFACE AUXILIARY GROUP

The PRINT auxiliary group configures the RS-232-C and IEEE-488 interface operation, and the printout generation. The IEEE-488 provides an IEEE-488 interface. Refer to Section 3 when the selected interface drives a printer. Refer to The T-BERD 310 Remote Control User's Manual when the selected interface is connected to a computer or terminal for remote operation. The PRINT auxiliary group is described as follows:

2.65.1 INTERVAL — Timed Printout Interval

PRINT	↑ hour ↓	↑ minute ↓
INTERVAL	8	00

The PRINT-INTERVAL auxiliary function allows you to select the amount of time between printouts when the PRINT-PRINT EVENT auxiliary function is set to TIMED. The maximum time that can be entered is 24 hours 59 minutes. The minimum time that can be entered is 00 hours 01 minute. Press the **RESULTS I Results** switch to set the hours from 0 to 24 hours. Press the **RESULTS II Results** switch to set the minutes from 00 to 59 minutes. The printout format is determined by the PRINT-FORMAT and PRINT-MODE auxiliary functions.

2.65.2 MODE — Printout Mode

PRINT	↑ select ↓
MODE	CONTINUOUS

The PRINT-MODE auxiliary function selects how the results are accumulated for all PRINT-PRINT EVENT auxiliary function positions. Press the **RESULTS I Results** switch to select one of the following.

2.64 TIME — TIME AND DATE AUXILIARY GROUP

The TIME auxiliary group controls the date and time for the battery-backed clock, and the test length for timed tests. The TIME auxiliary group is described as follows:

2.64.1 SET TIME — Set Time

TIME	↑ hour ↓	↑ minute ↓
SET TIME	12	25

The TIME-SET TIME auxiliary function sets the time for the battery-backed clock. The current time of day is displayed in the TIME category and printed on all printouts. Press the **RESULTS** switches to select the desired time:

RESULTS I Results switch — Press this switch to set the hour in a 24-hour clock format.

RESULTS II Results switch — Press this switch to set the minutes from 00 to 59 minutes.

2.64.2 SET DATE — Set Date

TIME	↑ month ↓	↑ day ↓
SET DATE	JAN	1

The TIME-SET DATE auxiliary function sets the month and the day. The current month and day are displayed in the TIME category and printed on all printouts. Press the **RESULTS** switches to select the desired date:

RESULTS I Results switch — Press this switch to set the month from JAN to DEC.

RESULTS II Results switch — Press this switch to set the day from 1 to 31.

2.64.3 TEST LENGTH — Set Test Length

TIME	↑ hour ↓	↑ minute ↓
TEST LENGTH	12	25

The TIME-TEST LENGTH auxiliary function sets the timed test length when the TIME-TEST auxiliary function is set to TIMED. If the test length is changed, a test restart occurs when the auxiliary function is exited. The timed test range is from 00:01 to 999:59. Press the **RESULTS** switches to select the desired test length:

RESULTS I Results switch — Press this switch to set the hour from 0 to 999 hours.

RESULTS II Results switch — Press this switch to set the minutes from 00 to 59 minutes.

CONTINUOUS — Results are continuously accumulated for the duration of the test.

DELTA — Results are accumulated from a test restart or the previous delta printout. As the printout is sent to the print buffer, the test result counters are reset to zero.

NOTE

The DELTA mode selection does not affect front-panel results, power-down test results printouts, squelch-off test results printouts, and manual test results printouts.

2.65.3 FORMAT — Printout Format

PRINT	↑ select ↓
FORMAT	NORMAL

The PRINT-FORMAT auxiliary function selects the format for the test results printouts. Press the **RESULTS I Results** switch to select one of three formats:

NORMAL — The NORMAL RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs and all results by category for the current T-BERD 310 configuration.

SUMMARY — The SUMMARY RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs and current SUMMARY category results.

CUSTOM — The CUSTOM RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs, FEAC codes, and test results selected through the PRINT-CUSTOM auxiliary function.

2.65.4 CUSTOM — Customized Printout Contents

PRINT	↑ select ↓	↑ on off ↓	
CUSTOM	SIGNAL PRES	OFF	

The PRINT-CUSTOM auxiliary function selects specific test results, FEAC codes, and Status and Alarm LED conditions to be included in a custom test results printout. Press the **RESULTS** switches to select the desired printout line items:

RESULTS I Category switch — Press this switch to select the desired category. The Status and Alarm LEDs and FEAC codes are selected from the SUMMARY category. Select the test results from the other categories.

RESULTS I Results switch — Press this switch to select the results and LEDs.

RESULTS II Results switch — Press the up arrow to toggle ON or the down arrow to toggle OFF the status condition.

NOTE

To generate a custom test results printout, set the PRINT-FORMAT auxiliary function to CUSTOM.

Refer to Section 2.89 for the list of categories and results. If the DS1 Insert/Secondary DS3 Receive Option is installed, the **RESULTS I SECONDARY** switch can be pressed to select the desired secondary DS3 results for the customized test results printout.

2.65.5 GRAPH — Print Pulse Shape Graph

PRINT	↑ print ↓
GRAPH	PULSE

The PRINT-GRAPH auxiliary function generates the pulse shape graph printout. Press the **RESULTS I Results** switch to print the pulse shape graph. Select pulse shape mask with the MISC-PULSE MASK auxiliary function. Set PRINT-PARITY auxiliary function to NONE (character length to 8 bits) to properly print a graph.

2.65.6 BAUD RATE — RS-232 Interface Baud Rate

PRINT	↑ select ↓
BAUD RATE	2400

The PRINT-BAUD RATE auxiliary function selects the RS-232 interface baud rate. Press the **RESULTS I Results** switch to select one of the following: 110, 300, 600, 1200, 2400, 4800, or 9600.

2.65.7 PARITY — RS-232 Interface Parity

PRINT	↑ select ↓
PARITY	NONE

The PRINT-PARITY auxiliary function selects the RS-232 interface parity. Press the **RESULTS I Results** switch to select one of the following:

NONE — Parity is disabled and the data output is configured for an 8-bit character length. Parity must be set to NONE to print the pulse shape graph.

EVEN — Even parity is enabled with the data output configured for a 7-bit character length.

ODD — Odd parity is enabled with the data output configured for a 7-bit character length.

MODEM — Selects the installed Internal Modem Option. The modem selection only appears, and becomes the powerup default, when the modem is installed (PRINT-BAUD RATE and PRINT-PARITY are UNAVAILABLE). The other PRINT auxiliary functions do not affect modem operation.

2.65.11 PRINT EVENT — Set Printout Event Criteria

PRINT	↑ select ↓
PRINT EVENT	OFF

The PRINT-PRINT EVENT auxiliary function selects the event that automatically initiates a test results printout. When a print event is selected (other than OFF), the following conditions can occur:

- A test results printout is generated at the indicated time or event.
- Status or alarm messages are automatically generated as appropriate.
- At power-up, the power-down test results printout is generated.
- The printer squelch function is enabled.
- A test end test results printout occurs if a timed test is completed.

Press the **RESULTS I Results** switch to select one of the following print event functions:

OFF — The print event functions are disabled, the print buffer is cleared, and status or alarm messages are not printed.

15 MIN — A test results printout is generated every 15 minutes after test restart.

30 MIN — A test results printout is generated every 30 minutes after test restart.

TIMED — A test results printout is generated at a user-specified interval. The print interval is set using the PRINT-INTERVAL auxiliary function. The PRINT-MODE auxiliary function sets the print mode: continuous and delta.

ERR SEC — A test results printout occurs for every occurrence of an errored second after test restart.

TEST END — A test results printout is generated when the timed test has expired. The timed test is selected when the TIME-TEST auxiliary function is set to TIMED. The TIME-TEST LENGTH auxiliary function controls the test interval. This selection only allows the test end test results printout to be generated.

NOTE

If any of the print events (except OFF) are selected and the TIME-TEST auxiliary function is set to TIMED, the selected print event (e.g., 30 MIN) and the test end test results printouts are generated at the appropriate time.

2.65.8 TERMINATOR — Printout Line Terminator

PRINT	↑ select ↓
TERMINATOR	CR

The PRINT-TERMINATOR auxiliary function selects the end-of-line terminator characters for both printouts and remote control devices. Press the **RESULTS I Results** switch to select one of the following line terminator characters:

CRLF — Carriage Return and Linefeed
CR — Carriage Return
LF — Linefeed

2.65.9 WIDTH — Printout Line Width

PRINT	↑ select ↓
WIDTH	40

The PRINT-WIDTH auxiliary function selects the character line width for printouts and terminal displays. Press the **RESULTS I Results** switch to select either a 40- or 80-column width.

2.65.10 PORT — Printer/Remote Control Interface Port Selection

PRINT	↑ select ↓
PORT	RS-232

The PRINT-PORT auxiliary function selects between the RS-232 (standard), IEEE-488, or 310-19 Internal Modem Option for printer or remote control operation. Only one interface can be selected at one time.

Press the **RESULTS I Results** switch to select one of the following interfaces:

RS-232 — Selects the side-panel RS-232 interface connector.

IEEE-488 — Selects the side-panel IEEE-488 interface connector and configures it for remote control operation with a compatible IEEE-488 controller. Press the **RESULTS II Results** switch to select the bus address from 0 to 30 for the T-BERD 310.

PRINT	↑ select ↓	↑ select ↓
PORT	IEEE-488	1

488 T/O — Selects the side-panel IEEE-488 interface connector and configures it for a talk-only mode to drive a compatible IEEE-488 printer.

PRINT	↑ select ↓
PORT	488 T/O

2.65.12 PRINT TYPE — Set Printout Type

PRINT	↑ print ↓	↑ print ↓
PRINT TYPE	RESULTS	CONTROLS

The PRINT-PRINT TYPE auxiliary function initiates either a test results or controls printout. Press the **RESULTS I Results** switch to select one of the following printouts:

RESULTS — This generates a date- and time-stamped printout of the current test results. Test results become available only after the T-BERD 310 has received a valid signal. The test results can be customized through the PRINT-FORMAT and PRINT-CUSTOM auxiliary functions.

CONTROLS — This generates a date- and time-stamped printout of the current front-panel and auxiliary function configurations. This printout records how the T-BERD 310 is configured for a test.

2.66 MISC — MISCELLANEOUS AUXILIARY GROUP

The MISC auxiliary group controls the user-programmable test pattern, X-bit transmission, Blue Signal detection criteria, DS1 line coding, beep criteria, and the pulse shape mask. The MISC auxiliary group is described as follows:

2.66.1 USER1 — User 1 Programmable Test Pattern

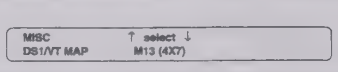
MISC	↑ forward rev ↓	↑ toggle end ↓
USER1	000	

The MISC-USER1 auxiliary function programs a 3- to 24-bit user-programmable test pattern. This allows the T-BERD 310 to transmit specific patterns to test circuit sensitivity. The pattern is transmitted when the USER1 pattern is selected with the **PATTERN** switch. The pattern is transmitted in left-to-right order. A test restart of the T-BERD 310 occurs when the pattern is saved while the USER1 pattern is transmitted. The test pattern is programmed with the following switches:

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to 24 bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit between "1" and "0". Press the down arrow to end or save the bit pattern from the position of the cursor to the first bit on the left. Any bits to the right of the cursor are deleted when the down arrow is pressed. The pattern is saved when *end* is selected.

2.66.2 DS1/VT MAP — DS1/VT Mapping Select



The MISC-DS1/VT MAP auxiliary function selects DS1 channel format scrolling order that appears in the SONET-VT **Channel Control INSERT** and **Channel Control DROP** switches when a DS1 payload is selected. Table 2-6 provides a translation between the VT Group/Channels and the SONET SPE columns.

Press **RESULTS I Results** switch to select one of the following DS1 channel formats:

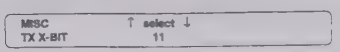
M13 (4x7) — Enables DS1 signals to be selected sequentially through seven VT1.5 groups with the first four channels in the first group, the second four channels in the second group, and so forth. The groups are numbered from 1 to 7 and VT channels are numbered from 1 to 4. The scrolling order appears in the INSERT and DROP displays as follows: 1-1, 1-2, 1-3, 1-4, 2-1, 2-2, 2-3, to 7-1, 7-2, 7-3, and 7-4.

TR-253 — Enables DS1 signals to be selected sequentially through seven VT1.5 groups with the first channels of the VT groups numbered first, the second channels of the VT groups numbered second, and so forth. Groups are numbered from 1 to 7 and the VT channels are numbered from 1 to 4. This format conforms with Bellcore GR-253 specifications for identifying VT1.5 channels. The scrolling order appears in the INSERT and DROP displays as follows: 1-1, 2-1, 3-1, 4-1, 5-1, 6-1, 7-1, 1-2, 2-2, 3-2, 4-2, to 1-4, 2-4, 3-4, 4-4, 5-4, 6-4, and 7-4.

Table 2-6. VT Group/Channel Translation

VT Group/ Channel	SONET SPE Column	VT Group/ Channel	SONET SPE Column
1-1	2,31,60	1-3	16,45,74
2-1	3,32,61	2-3	17,46,75
3-1	4,33,62	3-3	18,47,76
4-1	5,34,63	4-3	19,48,77
5-1	6,35,64	5-3	20,49,78
6-1	7,36,65	6-3	21,50,79
7-1	8,37,66	7-3	22,51,80
1-2	9,38,67	1-4	23,52,81
2-2	10,39,68	2-4	24,53,82
3-2	11,40,69	3-4	25,54,83
4-2	12,41,70	4-4	26,55,84
5-2	13,42,71	5-4	27,56,85
6-2	14,43,72	6-4	28,57,86
7-2	15,44,73	7-4	29,58,87

2.66.3 TX X-BIT — X-Bit Transmission



The MISC-TX X-BIT auxiliary function determines how the T-BERD 310 transmits the X-bits in all modes except THRU and UNFRAMED. Press the **RESULTS I Results** switch to select the required bit pattern: 11, 00, or EMULATE. EMULATE causes the T-BERD 310 to automatically transmit the X-bits according to the received signal frame status. If the received framing is lost, 00 (Yellow Alarm) is transmitted. If the receive framing is valid, 11 (no Yellow Alarm) is transmitted.

NOTE

If either pattern, IDLE (1100) or BLUE (1010), is transmitted, the T-BERD 310 overrides the 00 bit pattern and transmits 11.

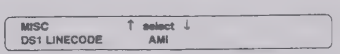
2.66.4 BLU SIG CRI — Blue Signal Detection Criteria

The MISC-BLU SIG CRI auxiliary function selects the Blue Signal detection criteria. Changing the auxiliary function causes a test restart. Press the **RESULTS I Results** switch to select one of the following detection criteria:

STUCK C-BIT — The T-BERD 310 declares a Blue Signal based primarily on receiving a signal with the C-bits set to zero.

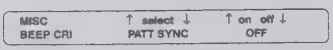
1010 — The T-BERD 310 declares a Blue Signal if the received signal contains a 1010 pattern.

2.66.5 DS1 LINECODE — DS1 Drop Output Line Coding



The MISC-DS1 LINECODE auxiliary function selects the DS1 line code, for the side-panel DS1 DROP output connector. Press the **RESULTS I Results** switch to select either **AMI** or **B8ZS** DS1 line coding.

2.66.6 BEEP CRI — Beep Criteria



The MISC-BEEP CRI auxiliary function selects the criteria for the T-BERD 310 to generate an audible warning. Press the **RESULTS I Results** switch to select the criteria. Press the **RESULTS II Results** switch to toggle the criteria ON or OFF.

PATT SYNC — The T-BERD 310 beeps when pattern synchronization occurs (DS3 Pattern Sync LED illuminated).

THR ERR SEC — The T-BERD 310 beeps once a second when the errored second threshold (ERR RECEIVE-ERROR THR auxiliary function) is exceeded.

ERROR EVENT — The T-BERD 310 beeps once a second when a non-zero test result appears in the SUMMARY category. This includes primary and secondary DS3 signal results and SONET overhead results.

DS1 SCANTRIG — The T-BERD 310 beeps when an event occurs during a DS1/DS0 Analyzer Option triggered DS1 scan mode test. Select the trigger event with the AUX-SCAN TRIG function. This selection is only available with the installed DS1/DS0 Analyzer Option.

2.66.7 PULSE MASK — Pulse Shape Mask

The MISC-PULSE MASK auxiliary function selects the pulse mask used to evaluate the received signal pulse shape. The selected pulse mask appears on the pulse shape graph printout (PRINT-GRAPH auxiliary function). Changing the PULSE MASK causes a test restart. Press the **RESULTS I Results** switch to select one of the following pulse masks:

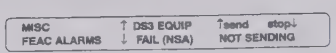
NONE — The pulse shape is not evaluated against a pulse mask specification. However, the pulse shape measurements are still made. When selected, the PULSE SHAPE result indicates N/A.

ANSI — The pulse shape is evaluated against the ANSI T1.102-1991 Network Interface pulse mask specification.

93 ANSI — The pulse shape is evaluated against the ANSI T1.102-1993 and ANSI T1.404-1993 Network Interface pulse mask specification.

CCITT — The pulse shape is evaluated against the proposed CCITT G.703 network interface pulse mask recommendation.

2.66.8 FEAC ALARMS — FEAC Message Alarm Control



The MISC-FEAC ALARMS auxiliary function is used to transmit Far-End Alarm and Control (FEAC) alarm messages. Press the **RESULTS I Results** switch to scroll through the following messages.

DS3 EQUIP FAIL (NSA) — DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure).

DS3 EQUIP FAIL (SA) — DS3 Equipment Failure, Service Affecting (Type 1 equipment failure).

DS3 LOS/HBER — DS3 Loss-of-Signal/High Bit Error Ratio.

DS3 OUT OF FRAME — DS3 Out-of-Frame, Loss of DS3 Frame Synchronization.

DS3 AIS RECEIVED — DS3 Alarm Indication Signal Received.

DS3 IDLE RECEIVED — DS3 Idle Signal Received.

COMM EQUIP FAIL (NSA) — Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure).

DS1 EQUIP FAIL (NSA) — DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure).

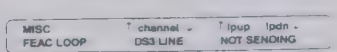
DS1 EQUIP FAIL (SA) — DS1 Equipment Failure, Service Affecting (Type 1 equipment failure).

SINGLE DS1 LOS/HBER — Single DS1 Loss-of-Signal/High Bit Error Ratio.

MULT DS1 LOS/HBER — Multiple DS1 Loss-of-Signal/High Bit Error Ratio.

Press the **RESULTS II Results** switch up arrow to *send* (*SENDING* appears) the alarm message and the down arrow to *stop* (*NOT SENDING* appears) the message. Only one alarm message is transmitted at one time for 1 second. The FEAC alarms can only be transmitted in the C-BIT and MUXED C-BIT modes. *N/A* appears in the RESULTS II window when the FEAC alarm messages do not apply to the selected operating mode.

2.66.9 FEAC LOOP — FEAC Message Loopback Control



The MISC-FEAC LOOP auxiliary function is used to transmit FEAC loop-code messages. The loop-code messages can loop up or loop down the DS3 line, a DS1 channel, or all DS1 channels. The FEAC alarms can only be transmitted in the C-BIT and MUXED C-BIT modes. *N/A* appears in the RESULTS II window when the FEAC loop-code messages do not apply to the selected operating mode. Press the **RESULTS I Results** switch to scroll through the following loop-code messages.

DS3 LINE — Loopback the DS3 line at the DS3 multiplexer.

DS3 NIU — Loopback the DS3 network interface unit.

ALL DS1s — Loopback all the low-speed DS1 channels at the DS3 multiplexer.

DS1 #1 - 28 — Loopback the selected low-speed DS1 channel at the DS3 multiplexer.

Press the **RESULTS II Results** switch up arrow to *send* the loop-up code and the down arrow to *send* the loop-down code. When the loop-up code is transmitted, *LOOPING UP* appears in the RESULTS II window until the loopback is established or when 1 second is exceeded. When the loop-down code is transmitted, *LOOPING DOWN* appears in the RESULTS II window until the loopback is released or when 1 second is exceeded. *NOT SENDING* appears when the loop code is not being transmitted. Only one loop code can be transmitted at a time.

2.66.10 LCD CONTRAST — DS1/DS0 Analyzer Option Display Contrast Control

MISC	↑ select ↓
LCD CONTRAST	5

The MISC-LCD CONTRAST auxiliary function adjusts the DS1/DS0 Analyzer Option display contrast. Press the **RESULTS I Results** switch to adjust the contrast ten different contrast levels. Adjust the contrast for the best viewing angle.

NOTE

This function is not available on older T-BERD 310s.

2.66.11 DS1 SIG BITS — DS1 Signaling Transfer Mode

MISC	↑ select ↓
DS1 SIG BITS	PASS-THRU

The MISC-DS1 SIG BITS auxiliary function controls the DS1 signaling transfer mode for DS1 signals carried in the VT1.5 byte-synchronous channel. The selected function affects both drop and insert signals. This auxiliary function appears with either the installed 310-13R, 310-13T, 310-14R, or 310-14T option.

Select — Press the **RESULTS I Results** switch to select one of the following transfer modes:

PASS-THRU — Allows the embedded DS1 signaling bits (if any) to pass through with the DS1 signal.

OUT-SLOT — On the inserted DS1 signal, this mode copies the DS1 signaling bits into the VT overhead. In addition, if the DS1 signal is a superframe format, the signaling bits are set to 1. On the dropped DS1 signal, replaces the signaling bits from the VT overhead to the DS1 robbed bit frames. When applied to a dropped ESF payload, the CRC is recalculated for each DS1 superframe. The DS1 ESF datalink is not manipulated when recalculating CRCs.

DSX — Sets the transmit output signal level to 0.6 Vp. Use this setting to send the DS3 signal from the DSX-3 patch panel IN connector. The signal level is equal to a HIGH signal sent through 450 feet of coaxial cable.

LOW — Sets the transmit output signal level to 0.3 Vp. Use this setting to stress-test the DS3 input to a multiplexer. The signal level is equal to a HIGH signal sent through 900 feet of coaxial cable.

2.67 SONET RX — SONET RECEIVE AUXILIARY GROUP

The following auxiliary functions select the DS1 channel and output, STS receive level, and DCC access. They only appear when a SONET option is installed.

2.67.1 DS1 DROP OUT — DS1 Drop Output Source

SONET RX	↑ select ↓
DS1 DROP OUT	SONET

The SONET RX-DS1 DROP OUT auxiliary function selects the DS1 source for the side-panel DS1 DROP connector.

Select — Press the **RESULTS I Results** switch to select one of the following sources:

DS3 — Drops the DS1 signal from the specified DS3 source. When the **DS3 SOURCE** switch is set to EXTERNAL, the DS1 channel is dropped from the DS3 signal received through the DS3 RECEIVE connector. When the **DS3 SOURCE** switch is set to SONET, the DS1 channel is dropped from the SONET DS3 payload received through a SONET input connection.

SONET — Selects the SONET input as the DS1 source. This allows a DS1 channel to be dropped from the SONET DS1 payload received through a SONET input connection. With the installed 310-13R or 310-14R option, select the dropped DS1 channel with the User Interface **CHANNEL CONTROL** switch set to DS3-DS1.

2.67.2 STS RX LEVEL — STS Receive Level

SONET RX	↑ select ↓
STS RX LEVEL	DSX

The SONET RX STS RX LEVEL auxiliary function selects the STS input signal level range for the side-panel STS-1 RECEIVE connector.

Select — Press the **RESULTS I Results** switch to select one of the following levels.

DSX — Select for signal levels received at a DSX level.

HIGH — Select for signal levels received at a high level.

2.66.12 DS1 BITS CLK — DS1 BITS Clock Termination

MISC	↑ select ↓
DS1 BITS CLK	TERM

The MISC-DS1 BITS CLK auxiliary function controls the DS1 BITS CLOCK connector input termination. This auxiliary function appears only with the 310-13T, 310-14T, or 310-14T-DUAL option installed.

Select — Press the **RESULTS I Results** switch to select one of the following input terminations:

TERM — Terminates an unterminated input signal across 100 ohms.

BRIDGE — Terminates the input signal across 1000 ohms to bridge terminated lines.

2.66.13 DS3 LEVEL — Set DS3 Transmit and Receive Levels

MISC	↑ transmit ↓	↑ receive ↓
DS3 LEVEL	DSX	DSX

The MISC-DS3 LEVEL auxiliary function sets the transmit and receive level for the DS3 TRANSMIT and DS3 RECEIVE connectors.

RECEIVE — Press the **RESULTS I Results** switch to select one of the following DS3 input signal equalization levels for the DS3 RECEIVE connector:

HIGH — The receiver accepts a nominal signal level of 1.2 Vp (0 feet of cable attenuation from a HIGH source). When presented with cable attenuation, the input signal level may range from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal input level (0.9 Vp). When presented with resistive attenuation, the signal level may range from +6 dB of gain to -26 dB of loss from the nominal input level (0.9 Vp).

DSX — The receiver accepts a nominal signal level of 0.6 Vp (450 feet of cable attenuation from a HIGH source). When presented with cable attenuation, the input signal level may range from + 6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal level (0.5 Vp). When presented with resistive attenuation, the input signal level may range from +6 dB of gain to -26 dB of loss from the nominal level (0.5 Vp).

LOW — The receiver accepts a nominal signal level of 0.3 Vp (900 feet of cable attenuation from a HIGH source). When presented with cable attenuation, the input signal level may range from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal level (0.2 Vp). When presented with resistive attenuation, the input signal level may range from +6 dB of gain to -20 dB of loss from the nominal level (0.2 Vp).

TRANSMIT — Press the **RESULTS I Results** switch to select one of the following DS3 output levels for the DS3 TRANSMIT connector:

HIGH — Sets the transmit output signal level to 1.2 Vp. Use this setting to send the DS3 signal from the DS3 terminal location towards the DSX-3 patch panel.

2.67.3 SONET DCC — SONET Data Communication Channel Drop and Insert Control

SONET RX	↑ select ↓
SONET DCC	LINE

The SONET RX-SONET DCC auxiliary function controls the drop and insert capabilities for the DCC. The DCC is accessed through the DCC DROP/INSERT connector on the 310-13R or 310-14R option. The auxiliary function only appears with the installed 310-13R or 310-14R option. The 310-13R/T pair or 310-14R/T pair allows for full DCC drop and insert capabilities.

Select — Press the **RESULTS I Results** switch to select either the Line or Section DCC to drop and insert the DCC through the DCC DROP/INSERT connector. Section and Line DCC are only valid in the STS ID 1 of an STS-N signal.

LINE — Selects the Line DCC. The Line DCC is contained in bytes D4 through D12. An all-zeros pattern is transmitted on the Section DCC.

SECTION — Selects the Section DCC. The Section DCC is contained in bytes D1, D2, and D3. An all-zeros pattern is transmitted on the Line DCC.

NONE — The DCC drop and insert function is disabled. An all-zeros pattern is transmitted over both channels.

2.67.4 SECTION BIP — Section BIP Calculation Control

SONET RX	↑ select ↓
SECTION BIP	ON

The SONET RX-SECTION BIP auxiliary function selects whether or not the Section BIP calculation is enabled. Press the **RESULTS I Results** switch to select one of the following:

ON (default) — Calculates Section BIPs. This setting should be selected when testing on the *line side* of a circuit.

OFF — Disables the Section BIP calculation when testing on the *drop side* of a circuit. The following Section test results are not applicable when disabled: SECT BIP ERR, SECT EQU BER, SECT BIP ES, SECT BIP ESA, SECT BIP ESB, and SECT BIP SES.

2.68 SONET TX — SONET TRANSMIT AUXILIARY GROUP

The following auxiliary functions select the SONET output signal, the inserted payload format, transmit timing source, STS transmit level, error insertion, alarm generation, SPE pointer manipulation, orderwire drop and insert, and path trace message insertion.

2.68.1 STS TX LEVEL — STS Transmit Level

SONET TX	↑ select ↓
STS TX LEVEL	DSX

The SONET TX-STS TX LEVEL auxiliary function selects the output signal level for the side-panel STS-1 TRANSMIT connector. This auxiliary function only appears with the installed 310-13T or 310-14T option.

Select — Press the **RESULTS I Results** switch to select one of the following levels:

DSX — Select to transmit the STS signal at a DSX level.

HIGH — Select to transmit the STS signal at a high level.

2.68.2 SONET ERR RT — SONET Error Rate Select

SONET TX	↑ select ↓	↑ frame err ↓
SONET ERR RT	1E-4	1

The SONET TX-SONET ERR RT auxiliary function selects the bit error rate for inserting bit interleaved parity (BIP) errors and far-end block errors (FEBE) in the transmitted SONET signal. It also selects the number of consecutive frame errors for inserting frame word errors. The user can select 1 to 32 consecutive frame word errors at the OC-12 and OC-48 rates (up to 5 at any other SONET rate). This auxiliary function only appears with the installed 310-13T or 310-14T option.

Select — Press the **RESULTS I Results** switch to select one of the following error rates: 1E-4, 1E-5, 1E-6, 1E-7, 1E-8, and 1E-9. (This error rate is applied via the BIP and FEBE selections of the User Interface error **INSERT** switch.)

Frame err — Press the **RESULTS II Results** switch to select one of the following number of consecutive frame errors: 1 to 5. (The number of errors is applied with the SONET FRAME selection of the User Interface error **INSERT** switch.)

If the following messages appear, the payload pointer cannot be manipulated.

(thru mode) — The T-BERD 310 is in SONET THRU mode.

(ais) — The T-BERD 310 is inserting a Line AIS or Path AIS alarm.

(lop) — The T-BERD 310 is inserting a Path LOP alarm.

+2 ndf -2 — Press the **RESULTS II Results** switch to cause the NDF to increment or decrement the payload pointer by ±2 bytes. Changing the NDF changes the payload pointer value in the RESULTS I window. It also disrupts the inserted payload data by either inserting extra zero bytes or by removing data bytes.

2.68.5 PATH TRACE — Path Trace Message Insertion Control

SONET TX	↑ select ↓	Message:
PATH TRACE	USER1	The quick b →

The SONET TX-PATH TRACE auxiliary function enables one of three default or user-defined messages to be transmitted over the path trace byte (J1) of the inserted STS-1 signal. The path trace message is a 64-byte ASCII message which includes spaces, null characters, and CR/LF line terminating characters. The default message strings are 64-bytes long. This auxiliary function is valid to insert the message with the installed 310-13T or 310-14T option. The 310-13R/T pair or 310-14R/T pair option allows for full drop and insert path trace capabilities

Select — Press the **RESULTS I Results** switch to select one of the following default messages to transmit:

USER1 — The quick brown fox jumps over the lazy dog 1234567890!@#$%&*

USER2 — Telecommunications Techniques Corporation... Expect Excellence

USER3 — T-BERD 310: Communications Analyzer for SONET, DS3, DS1, & DS0

The messages can be changed through the T-BERD 310 remote control function.

Message — The display acts as a window over the full message. If the message is longer than 12 characters, the first 11 characters and a right arrow (→) appear in the window. The right arrow indicates additional characters exist to the right of the window. Press the **RESULTS II Results** switch down arrow to move the window to the right; the message moves to the left. When the message moves to the left, a left arrow (←) also appears indicating additional characters exist to the left of the window. Press the **RESULTS II Results** switch up arrow to move the window to the left; the message moves to the right. When the window reaches the end of the message, the last 11 characters and a left arrow (←) appear in the window.

2.68.3 BIT ERR INS — SONET Payload Logic Error Insertion Rate Control

SONET TX	↑ one rate ↓
BIT ERR INS	OFF

The SONET TX-BIT ERR INS auxiliary function selects the error rate inserted into the OC-3c test pattern. Press the **RESULTS I Results** switch to select one of the following:

OFF (default) — Appears when the error insertion is off.

SINGLE — Press the up arrow to insert a single logic error into the selected OC-3c PRBS test patterns. When the switch is pressed, *SINGLE* flashes in the RESULTS I window, then *OFF* appears.

RATE 1E-X — Press the down arrow to insert logic errors at the selected error rate set by the SONET TX-SONET ERR RT auxiliary function. When selected, errors are immediately inserted and the top line changes from "***one rate***" to "***stop***". Press the switch again to stop the error insertion; *OFF* appears in the RESULTS I window. Error insertion can also be stopped by changing payload type, inserting alarms, inserting Line AIS, Path AIS, or Path LOP.

N/A — Appears when the indicated payload is not set to 2^23-1 (3c) or I2^23-1.

If one of the following messages appear, error insertion cannot be generated.

(thru mode) — The T-BERD 310 is in SONET THRU mode.

(ais) — The T-BERD 310 is inserting a Line AIS or Path AIS alarm.

(lop) — The T-BERD 310 is inserting a Path LOP alarm.

NOTE

VT and ATM alarms and errors cannot be inserted when the OC-3c test pattern is transmitted.

2.68.4 SPE POINTER — Synchronous Payload Envelope Pointer Control

SONET TX	↑ inc dec ↓	↑ +2 ndf -2 ↓
SPE POINTER	522	

The SONET TX-SPE POINTER auxiliary function manipulates the synchronous payload envelope (SPE) payload pointer. This auxiliary function only appears with the installed 310-13T or 310-14T option. The STS payload pointer cannot be manipulated in SONET THRU mode.

Inc/dec — Press the **RESULTS I Results** switch to increment or decrement the payload pointer value from 0 to 782. The value is reset to 522 when changing SONET payload related configurations. The displayed value is not saved in NOVRAM. The pointer value cannot be incremented/decremented from 0 to 782 or from 782 to 0 when changing SONET payload related configurations.

2.68.6 ORDERWIRE — Orderwire Channel Control

SONET TX	↑ select ↓
ORDERWIRE	LINE

The SONET TX-ORDERWIRE auxiliary function controls the drop and insert capabilities for the orderwire channel. The orderwire channel is accessed through the HANDSET connector on the 310-13T or 310-14T option. This auxiliary function only appears with the installed 310-13T or 310-14T option. The 310-13R/T pair or 310-14R/T pair option allows for full orderwire drop and insert capabilities.

Select — Press the **RESULTS I Results** switch to select either the Line or Section orderwire channel to drop and insert the orderwire channel through the HANDSET connector.

LINE — Selects the Line orderwire channel. A quiet tone is transmitted on the Section orderwire channel.

SECTION — Selects the Section orderwire channel. A quiet tone is transmitted on the Line orderwire channel.

NONE — The orderwire drop and insert function is disabled. A quiet tone is transmitted over both channels.

2.68.7 TX WAVELEN — Dual Wavelength Transmitter Control

SONET TX	↑ rate ↓	↑ wavelen ↓
TX WAVELEN	OC-1/3	1310 nm only
	OC-12	1550 nm only
	OC-48	1310 nm
	OC-48	1550 nm

The SONET TX-TX WAVELEN auxiliary function selects the optical wavelength for the selected data rate of the 310-21 Dual Wavelength SONET OC-48, OC-48c Transmitter Option, 310-12 Dual Wavelength SONET OC-12, OC-12c Transmitter Option, or 310-14T Dual Wavelength SONET OC-1 and OC-3 Transmitter Option. The Results I window allows the rate to be selected. The Results II window indicates the transmit wavelength (for single wavelength TX boards). It also allows the wavelength selection for dual wavelength TX boards. Therefore, for dual wavelength, the following appropriate option selection appears:

OC-1/3 — Press the **RESULTS II Results** switch to select the wavelength (1310 or 1550 nm) for the 310-14T Dual Wavelength SONET OC-1 and OC-3 Transmitter Option.

OC-12 — Press the **RESULTS II Results** switch to select the wavelength (1310 or 1550 nm) for the 310-12 Dual Wavelength SONET OC-12 Transmitter Option.

OC-48 — Press the **RESULTS II Results** switch to select the wavelength (1310 or 1550 nm) for the 310-12 Dual Wavelength SONET OC-48 Transmitter Option.

The two items under wavelength (1310 nm only and 1550 only) are indicators. They appear as an indication that the selected laser only transmits at the indicated wavelength. The OC-48 rate wavelength of 1310 and 1550 nm display when a dual wavelength TX laser is selected. It indicates the wavelength selected at the time.

2.69 ATM RX — ATM RECEIVE AUXILIARY GROUP

The following auxiliary functions configure the T-BERD 310 to accept and analyze DS1, DS3, OC-3c, or OC-12c ATM network interface, cell profile, primary test cell, cell bandwidth, and cell peak bandwidth and duration. The ATM RX group only appears when the 310-15 OC-3c ATM Analysis Option, the 310-17A DS1/DS3 ATM Analysis Option, or the 310-20 OC-12c ATM Analysis Option is installed. Unless otherwise indicated, the following auxiliary functions apply to these three options.

2.69.1 NETWORK I/F — Received ATM Network Interface Select

ATM RX	↑ select ↓	↑ scramble ↓
NETWORK I/F	UNI	ON

The ATM RX-NETWORK I/F auxiliary function selects the ATM network interface to be received and analyzed. It also controls the 48-byte cell payload descrambler.

Select — Press the **RESULTS I Results** switch to select one of the following ATM network interfaces:

UNI — Configures the ATM receiver to detect the user-to-network interface (UNI) cell format.

NNI — Configures the ATM receiver to detect the network node interface or network-to-network interface cell format.

Scramble — Press the **RESULTS II Results** switch to control the 48-byte cell payload descrambler:

ON — Enables the 48-byte cell payload descrambler.

OFF — Disables the 48-byte cell payload descrambler.

2.69.2 RATE SELECT — Received ATM Rate Select

ATM RX	↑ rate ↓
RATE SELECT	DS3

The ATM RX-RATE SELECT auxiliary function selects the appropriate data rate for ATM testing. Initial setup requires the ATM RX-RATE SELECT auxiliary function be set to the correct data rate (DS1, DS3, OC-3c, or OC-12c) before configuring the rest of the T-BERD 310. The data rate determines which connections, auxiliary functions, and test results are available to test ATM payloads.

Selecting *next* continues search for next address of selected mask. Selecting *use* stores the address found to the SRCH MASK for later use.

ATM RX	↑ select ↓	↑ next	use ↓
TEST MASK	TTC SEARCH	P0000	C01000

RDI SEARCH — Configure the receiver to look for the received ATM cells that match a stored header profile. With RDI SEARCH selected, pressing this switch displays *start* in RESULTS II window. RDI search locates the next RDI OA&M cell, after the user presses the **RESULTS II Results** switch, and displays its VPI/VCI address in the RESULTS II window

AIS SEARCH — Configure the receiver to look for the received ATM cells that match a stored header profile. With AIS SEARCH selected, pressing this switch displays *start* in RESULTS II window. AIS search locates the next AIS OA&M cell, after the user presses the **RESULTS II Results** switch, and displays its VPI/VCI address in the RESULTS II window.

SRCH MASK — Configure the receiver to look for the received ATM cells that match a stored header profile. Results can be performed on SRCH MASK when it is selected as Test Mask.

PROFILE n — Configure the receiver to look for the received ATM cells that match a stored header profile. Program the header profile through the ATM RX-PROFILE Pn auxiliary function. All masked results apply to the addresses fitting the programmed mask description.

NOTE

TX TEST delay variation, TTC SEARCH, RDI SEARCH, AIS SEARCH, and SRCH MASK may not be available for OC-12c ATM testing.

2.69.4 PROFILE Pn — Received ATM Cell Test Profile Control

ATM RX	↔	GFC	VPI	VCI	PT	CL	↑↓
PROFILE P1	dec	X	XX	XXXX	X	X	

The ATM RX-PROFILE Pn auxiliary function configures the ATM receiver to accept up to four specific test cell profiles (n = 1 to 4). This enables the ATM cell header fields — GFC, VPI, VCI, PTI, and CLP — to be preprogrammed with four different addresses. Test profiles are selected through with the ATM RX-TEST MASK auxiliary function.

Press the **PATTERN** switch to select each test profile, P1 to P4 or SRCH MASK.

↔ — Press the **RESULTS I Results** switch to move the cursor from left to right across the digits of each field.

↑↓ — Press the **RESULTS II Results** switch to change the value of the digit at the cursor. The ATM cell header fields can be set to the following values.

NOTE

If an invalid address is entered, the test instrument automatically changes the value to ensure a valid address. An X can be selected as a "don't care" position to allow any digit to be received.

NOTE

The ATM RX-RATE SELECT auxiliary function only appears when more than one ATM option is installed (i.e., 310-15 OC-3c ATM Analysis Option, 310-17A DS1/DS3 ATM Analysis Option, and/or 310-20 OC-12c ATM Analysis Option).

Select — Press the **RESULTS I Results** switch to select one of the following ATM rates:

DS1 — Configures the ATM receiver and transmitter to the DS1 rate. DS1 ATM (PLCP) or ATM (HEC) framing is available. Requires the 310-17A DS1/DS3 ATM Analysis Option and 310-1 DS1/DS0 Analyzer Option.

DS3— Configures the ATM receiver and transmitter to the DS3 rate. Requires the 310-17A DS1/DS3 ATM Analysis Option.

OC-3c — Configures the ATM receiver and transmitter to the OC-3c rate. Requires the 310-15 OC-3c ATM Analysis Option.

OC-12c — Configures the ATM receiver and transmitter to the OC-12c rate. Requires the 310-20 OC-12c ATM Analysis Option.

2.69.3 TEST MASK — Received ATM Cell Test Mask Control

ATM RX	↑ select ↓	↑ results ↓
TEST MASK	TX TEST	NORMAL

The ATM RX-TEST MASK auxiliary function selects the cell format to look for in the received signal.

Select — Press the **RESULTS I Results** switch to select one of the following ATM test masks:

TX TEST — Configure the receiver to look for the VPI/VCI of the transmitted test cell. TX TEST sets receive Mask to Primary Profile transmitted by T-BERD 310. Results are performed for each test mask P1-P4 or SRCH MASK. Press **RESULTS II Results** switch to toggle the type of results between normal results and delay variation mode.

PREVIEW — Configure the receiver to display the VPI/VCI address of the next received ATM cells after the user presses the **RESULTS II Results** switch. Selecting PREVIEW enables the ATM RX-PREVIEW auxiliary function (otherwise the auxiliary function is disabled).

ATM RX	↑ select ↓	↑ start ↓
TEST MASK	PREVIEW	P00000 C000000

TTC SEARCH — Configure the receiver to look for the received ATM cells that match a stored header profile. With TTC SEARCH selected, pressing this switch displays *start* in RESULTS II window. TTC SEARCH locates the next TTC test cell, after the user presses the **RESULTS II Results** switch, and displays its VPI/VCI address in RESULTS II window.

ATM RX	↑ select ↓	↑ start ↓
TEST MASK	TTC SEARCH	P000 C0000

GFC — For UNI cell format, the GFC range is 0 to F (hex), 00 to 15 (dec), or X. For NNI cell format, this field is not applicable.

VPI — For UNI cell format, VPI range is 00 to FF (hex), 000 to 255 (dec), or X (256 virtual paths). For NNI cell format, the VPI range is 000 to FFF (hex), 0000 to 4096 (dec), or X (4097 virtual paths).

VCI — VCI range is 0000 to FFFF (hex), 00000 to 65535 (dec), or X (65,536 virtual channels for each VPI).

PTI — PTI range is 0 to 7 (hex or dec) or X. PTI value defined as follows:

0 - User Data Cell, congestion not experienced, SDU-type.
1 - User Data Cell, congestion not experienced, SDU-type.
2 - User Data Cell, congestion experienced, SDU-type.
3 - User Data Cell, congestion experienced, SDU-type.
4 - Segment OAM F5 flow cell (for VC loopbacks and alarms).
5 - End-to-end OAM F5 flow cell (for VC loopbacks and alarms).
6 - Reserved for future traffic control and remote monitoring functions.
7- Reserved for future functions.
X- Don't care what value is received.

CL — CLP range is 0 or 1 (hex or dec) or X. 1 allows cell to be classified low priority and may be dropped. 0 classifies the cell as high priority and usually prevents cell from being dropped. ATM switches can change the CLP value when they detect congestion.

dec or **hex** — Indicator appears on the display indicating how the address fields are entered; decimal or hexadecimal (select with ATM RX-PROFILE BASE).

2.69.5 PREVIEW — Received ATM Cell Test Profile Preview Select

ATM RX	↑↓ start ↑↓	%BW	TYPE
PREVIEW	(0000)(00000)	N/A	N/A

The ATM RX-PREVIEW auxiliary function enables the test instrument to detect in-use VPI/VCI addresses and display approximate bandwidth usage, and indicate traffic types used by the address being analyzed.

↔ — Press the **RESULTS I Results** switch up arrow to locate the next active cell in the next numerically greater VP address. Press the down arrow to locate the next numerically lower VP active cell. Conversely, press the down arrow to move left.

↑↓ — Press the **RESULTS II Results** switch up to locate the next numerically greater VC if it exists in the same VC. Press the switch down to locate the next numerically lower VC if it exists in the same VC.

The following test results indicate the initial status of the VPI/VCI address being previewed:

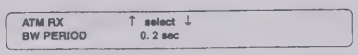
NOTE

Unless the TEST MASK function is set to PREVIEW, the PREVIEW auxiliary function will display N/A (not applicable).

BW — Measures the bandwidth of the selected profile. The range is 0.0% to 100.0%. BW results are returned when the cell is located.

TYPE — Indicates the traffic type of the selected profile. Traffic indicators use ais, rdi, live or test to indicate that the incoming cells are alarms (ais, rdi), test traffic (ttc), or user traffic (live).

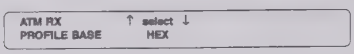
2.69.6 BW PERIOD — Received ATM Cell Test Profile Bandwidth Select



The ATM RX-BW PERIOD auxiliary function selects the period for burst bandwidth measurements being taken.

Select — Press the **RESULTS I Results** switch to select period to measure the bandwidth from 0.2 seconds to 9.9 seconds in 0.1 second steps.

2.69.7 PROFILE BASE — Set Test Profile Programming Mode



The ATM RX-PROFILE BASE auxiliary function enables either hexadecimal or decimal ATM VPI/VCI addressing to be entered through the ATM RX-PROFILE Pn, ATM TX-PROFILE Pn, and ATM RX-TEST MASK auxiliary functions. Changing the programming mode causes a test restart. Changing from one mode to the other automatically converts values for the selected mode; although, when an X is used, the entire field defaults to X.

Select — Press the **RESULTS I Results** switch to select one of the following address programming modes:

DECIMAL (default) — Allows addresses to be programmed with decimal values from 0 to 65535.

HEX — Allows addresses to be programmed with hexadecimal values from 0 to FFFF.

2.70 ATM TX — ATM TRANSMIT AUXILIARY GROUP

These auxiliary functions select the DS1, DS3, OC-3c, or OC-12c ATM network interface, cell profile, primary test cell, cell bandwidth, cell peak bandwidth and duration. The ATM TX group only appears when the 310-15 OC-3c ATM Analysis Option, the 310-17A DS1/DS3 ATM Analysis Option, or the 310-20 OC-12c ATM Analysis Option is installed.

VCI — VCI range is 0000 to FFFF (hex) or 00000 to 65535 (dec) (65,536 virtual channels for each VPI).

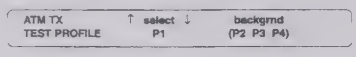
PTI — PTI range is 0 to 7 (hex or dec). PTI value defined as follows:

0 - User Data Cell, congestion not experienced, SDU-type.
1 - User Data Cell, congestion not experienced, SDU-type.
2 - User Data Cell, congestion experienced, SDU-type.
3 - User Data Cell, congestion experienced, SDU-type.
4 - Segment OAM F5 flow cell (for VC loopbacks and alarms).
5 - End-to-end OAM F5 flow cell (for VC loopbacks and alarms).
6 - Reserved for future traffic control and remote monitoring functions.
7- Reserved for future functions.

CL — CLP range is 0 or 1 (hex or dec). 1 allows cell to be classified low priority and may be dropped. 0 classifies the cell as high priority and usually prevents cell from being dropped. **ATM** switches can change the CLP value when they detect congestion.

dec or **hex** — Indicator appears on the display indicating how the address fields are entered; decimal or hexadecimal (select with ATM RX-PROFILE BASE).

2.70.3 TEST PROFILE — Transmitted ATM Cell Test Profile Select



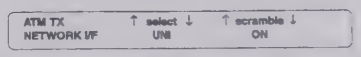
The ATM TX-TEST PROFILE auxiliary function selects the test profile to be transmitted as the primary test channel. The test profiles are created with the ATM TX-PROFILE Pn auxiliary function.

Select — Press the **RESULTS I Results** switch to select one of the following test profiles as the primary test channel.

P1 — Transmit test cell profile 1.
P2 — Transmit test cell profile 2.
P3 — Transmit test cell profile 3.
P4 — Transmit test cell profile 4.

Backgrnd — Indicates which test profiles are used as background traffic. In the previous example, P2, P3, and P4 are the background profiles and P1 is the primary test profile. The three test profiles not selected are used as the background channels. If a profile has not been defined, the default header is an idle cell.

2.70.1 NETWORK I/F — Transmitted ATM Network Interface Select



The ATM TX-NETWORK I/F auxiliary function selects the ATM network interface to be tested. It also controls the 48-byte cell payload scrambler.

Select — Press the **RESULTS I Results** switch to select one of the following ATM network interfaces:

UNI — Configures the ATM transmitter to send the user network interface (UNI) cell format.

NNI — Configures the ATM transmitter to send the network node interface or network-to-network interface cell format.

Scramble — Press the **RESULTS II Results** switch to control the 48-byte cell payload scrambler:

ON — Enables the 48-byte cell payload scrambler.

OFF — Disables the 48-byte cell payload scrambler.

2.70.2 PROFILE Pn — Transmitted ATM Cell Test Profile Control

The ATM TX-PROFILE Pn auxiliary function configures the ATM transmitter to transmit up to four specific test cell profiles (n = 1 to 4) one at a time. This enables ATM cell header fields — GFC, VPI, VCI, PTI, and CLP — to be preprogrammed with four different addresses. Test profiles are selected and transmitted with the ATM TX-TEST PROFILE auxiliary function.

Press the **PATTERN** switch to select each test profile, P1 to P4.

↔ — Press the **RESULTS I Results** switch to move the cursor from left to right across the digits of each field.

↑↓ — Press the **RESULTS II Results** switch to change the value of the digit at the cursor. The ATM cell header fields can be set to the following values:

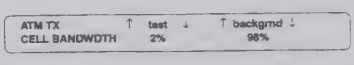
NOTE

If an invalid address is entered, the test instrument automatically changes the value to ensure a valid address.

GFC — For UNI cell format, the GFC range is 0 to F (hex) or 00 to 15 (dec). For NNI cell format, this field is not applicable.

VPI — For UNI cell format, VPI range is 00 to FF (hex) or 000 to 255 (dec) (256 virtual paths). For NNI cell format, the VPI range is 000 to FFF (hex) or 000 to 4096 (dec) (4097 virtual paths).

2.70.4 CELL BANDWDTH — Transmitted ATM Cell Test Profile Bandwidth Select

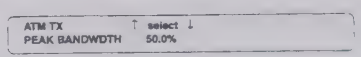


The ATM TX-CELL BANDWDTH auxiliary function sets the primary and background test profile and idle code bandwidth. The sum of the test, background, and idle cells equals the total bandwidth. For example, if the primary profile is set to 50% and the background profile is set to 30%, then the idle signal bandwidth automatically sets to 20%.

Test — Press the **RESULTS I Results** switch to select the primary test profile bandwidth from 0% to 100% in 0.1% steps for OC-3c and OC-12c and in 0.4% steps for DS1 and DS3.

Backgrnd — Press the **RESULTS II Results** switch to select the background test profile bandwidth from 0% to 100% in 0.1% steps for OC-3c and OC-12c and in 0.4% steps for DS1 and DS3.

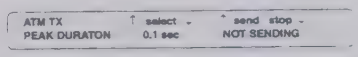
2.70.5 PEAK BANDWDTH — Transmitted ATM Cell Test Profile Peak Bandwidth Select



The ATM TX-PEAK BANDWDTH auxiliary function sets the percentage of burstiness for the primary test profile peak bandwidth. The burst bandwidth is taken from the available idle signal bandwidth first then the background cell bandwidth.

Select — Press the **RESULTS I Results** switch to select the burstiness from 0% to 99% in 1% steps.

2.70.6 PEAK DURATION — Transmitted ATM Cell Test Profile Peak Duration Select



The ATM TX-PEAK DURATION auxiliary function selects the peak pulse duration for the peak bandwidth and transmit the burst.

Select — Press the **RESULTS I Results** switch to select duration of the burst from 0.1 to 9.9 seconds in 0.1 second steps.

Send/Stop — Press the **RESULTS II Results** switch to send (up arrow) or stop (down arrow) the burst. *NOT SENDING* appears when the burst is not being transmitted. *SENDING* appears when the burst is being transmitted.

2.70.7 HEC ERR RATE — Transmitted ATM Header Error Control Error Rate

The ATM TX-HEC ERR RATE auxiliary function selects the error rate and the number of consecutive cells affected by the inserted errors. Refer to the ATM TX-HEC ERR INS auxiliary function to set the error type and control the transmitted errors.

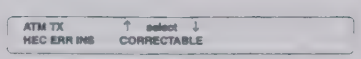
Select — Press the **RESULTS I Results** switch to select the HEC error rate as follows:

1E-3, 1E-4 ... 1E-8, 1E-9 — Inserts the selected error rate.

CONTINUOUS — Inserts HEC errors on all cells.

Burst — Press the **RESULTS II Results** switch to select the number of consecutive cells to be errored from 1 CELL to 10 CELLS.

2.70.8 HEC ERR INS — Transmitted ATM Header Error Control Error Insert Control



The ATM TX-HEC ERR INS auxiliary function selects the type of error inserted and controls the transmission of the errors. Refer to the ATM TX-HEC ERR RATE auxiliary function to set the error rate and the number of cells to be affected.

Select — Press the **RESULTS I Results** switch to select the type of error transmitted as follows:

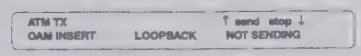
CORRECTABLE — Transmits a correctable HEC error which consists of a single error in the header.

NON-CORRECTABLE — Transmits a non-correctable HEC error which consists of two bit errors in the header.

(n/a) — HEC errors are not applicable in the current test instrument configuration.

When the errors are being inserted, the RESULTS II window changes from *burst rate* to *stop*. Pressing the **RESULTS II Results** switch with *stop* displayed disables the error insertion function.

2.70.9 OAM INSERT — Transmitted ATM OAM Insert Control

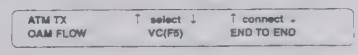


The ATM TX-OAM INSERT auxiliary function selects and inserts operation, administration and maintenance (OAM) fault management signals. Refer to the ATM TX-OAM FLOW auxiliary function to set the cell format and function.

LOOPBACK — Inserts ATM loopback cells into the primary transmit channel. ATM loopback cells are not loop codes that affect the physical network connectivity. They are routed by the proper **ATM** switch to be transmitted back to the transmit location; without affecting the other ATM traffic.

Send/Stop — Press the **RESULTS II Results** switch to send or stop the selected alarm or loopback cell. *NOT SENDING* appears when the alarm or loopback is not being transmitted. *SENDING* appears when the alarm or loopback is being transmitted. When the AIS and RDI cells are being transmitted, the T-BERD 310 automatically stops transmitting all other test cells on the primary channel. This is required to fully emulate the AIS and RDI operation. When the AIS and RDI cell transmission is stopped, the test cells are once again transmitted at the proper rates. N/A appears when the test instrument is not configured properly.

2.70.10 OAM FLOW — Transmitted ATM OAM Flow Control



The ATM TX-OAM FLOW auxiliary function selects OAM format and signal function for the alarm or loopback selected from the ATM TX-OAM INSERT auxiliary function.

Select — Press the **RESULTS I Results** switch to select one of the following OAM signal formats:

VP(F4) — Formats the OAM signal for a virtual path connection (VPC).

VC(F5) — Formats the OAM signal for a virtual channel connection (VCC).

Connect — Press the **RESULTS II Results** switch to select one of the following OAM signal functions:

SEGMENT — Establishes a link with the next network element in the path.

END TO END — Establishes a link with the last network element in the path.

2.70.11 PLCP ERR RT — Transmitted ATM PLCP Error Rate Control

The ATM TX-PLCP ERR RT auxiliary function selects the PLCP error rate. This auxiliary function only appears when the DS1/DS3 ATM Analysis Option is installed.

Select — Press the **RESULTS I Results** switch to select one of the following PLCP signal rates:

1 E-3 to 1 E-8 — Formats the PLCP signal for the rate of error insertion. Pressing the up arrow increments the value. Pressing the down arrow decrements the value.

SINGLE — Formats the PLCP signal for one error rate insertion.

2.70.12 PLCP ERR INS — Transmitted ATM PLCP Error Insert Control

The ATM TX-PLCP ERR INS auxiliary function selects the type of PLCP error inserted. This auxiliary function only appears when the DS1/DS3 ATM Analysis Option is installed.

Select — Press the **RESULTS I Results** switch to select one of the following PLCP error selectibes.

BIP — Formats the PLCP signal for bit interleaved parity error insertion.

RDI — Formats the PLCP signal for remote defect indication (yellow alarm) error insertion.

Send/Stop — Press the **RESULTS II Results** switch to send (up arrow) or stop (down arrow) the PLCP error type on the foreground channel. Press the down arrow to halt transmission and display *NOT SENDING*

2.70.13 CORRELATION — Transmitted ATM Correlation Tag Control

The ATM TX-CORRELATION auxiliary function configures the transmitted correlation tag in the test cell. This allows cells from multiple T-BERD 310 units to be differentiated from one another. The correlation tag is two bytes long. The entered value is transmitted from left to right. It also allows end-to-end ATM connectivity testing, much like path and trace testing in SONET.

↔ — Press the **RESULTS I Results** switch to move the cursor from left to right across the digits of the field. Press the up arrow to move the cursor to the right. Conversely, press the down arrow to move left.

↑↓ — Press the **RESULTS II Results** switch to change the value of the digit at the cursor. The range is 0 to F for each digit; each digit represents four bits within the 2 byte tag.

2.71 OPTICAL TEST — OPTICAL TEST AUXILIARY GROUP

The following auxiliary functions only appear when the 310-16 Optical Media Test Option is installed. The auxiliary functions configure the stable source for return loss measurements, setting the return loss measurement type, and power meter wavelength.

2.71.1 OPTICAL PWR — Optical Power Measurement Control

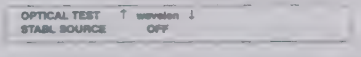
The OPTICAL TEST-OPTICAL PWR auxiliary function controls the wavelength for the POWER METER connector. The optical power measurement result appears in the SIGNAL category.

Wavelen — Press the **RESULTS I Results** switch to select one of the following wavelengths:

1310 nm — Enables the optical power detector and optical power measurement test result for 1310 nm.

1550 nm — Enables the optical power detector and optical power measurement test result for 1550 nm.

2.71.2 STABLE SOURCE — Optical Stable Source Select



The OPTICAL TEST-STABLE SOURCE auxiliary function controls the wavelength of the RETURN LOSS/SOURCE connector on the Optical Media Test Option.

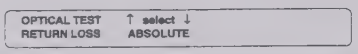
Select — Press the **RESULTS I Results** switch to select one of the following uses for the RETURN LOSS/SOURCE connector:

OFF — Disables the RETURN LOSS/SOURCE connector.

1310 nm — Sets the laser source wavelength for 1310 nm.

1550 nm — Sets the laser source wavelength for 1550 nm.

2.71.3 RETURN LOSS — Return Loss Measurement Type

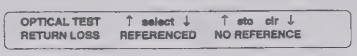


The OPTICAL TEST-RETURN LOSS auxiliary function sets the type of return loss measurement being performed when the OPTICAL TEST-STABLE SOURCE auxiliary function is enabled.

Select — Press the **RESULTS I Results** switch to select one of the following return loss types:

ABSOLUTE — Configures the return loss measurement to measure all return loss starting with the RETURN LOSS/SOURCE connector.

REFERENCED — Configures the return loss measurement to measure all return loss except from the RETURN LOSS/SOURCE connector. Selecting REFERENCED displays the **sto/clr** window.



Sto/clr — Press the **RESULTS II Results** switch up arrow to display one of the following conditions:

NO REFERENCE — No reference is stored. The RETURN LOSS/SOURCE connector return loss has not been measured. When displayed, press the **RESULTS II Results** switch up arrow to store the reference.

REF STORED — A reference is stored. The RETURN LOSS/SOURCE connector return loss has been measured. Before pressing the **RESULTS II Results** switch up arrow, wrap the fiber cable in a tight loop around a pencil 5 to 10 times to create a mandrel wrap. The mandrel wrap cancels out the fiber and allows the T-BERD 310 to measure the return loss of the cable. The stored value is canceled out of the return loss measurement. This procedure allows a more accurate measurement to be made by eliminating the dominant reflection from the connector.

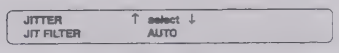
(source off) — Indicates the stable source is off. Enable the stable source with the OPTICAL TEST-STABLE SOURCE auxiliary function.

Press the **RESULTS II Results** switch down arrow to clear the stored reference. The RETURN LOSS test result appears in the SIGNAL category.

2.72 JITTER — DS3 JITTER AUXILIARY GROUP

The following 310-10 DS3 Jitter Option auxiliary functions only appear when the option is installed. The auxiliary functions establish jitter filter bandpass, jitter scale, and jitter threshold conditions to measure jitter.

2.72.1 JIT FILTER — Jitter Bandpass Filter Select



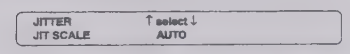
The JITTER-JIT FILTER auxiliary function selects one of three jitter bandpass filter configurations to measure the jitter frequency. Press the **RESULTS I Results** switch to select one of the following filters:

WIDEBAND — Selects a wideband filter (10 Hz to 400 kHz). The HB JITTER and MAX HB JIT results are not available with this selection.

HIGHBAND — Selects a highband filter (30 kHz to 400 kHz). The WB JITTER and MAX WB JIT results are not available with this selection.

AUTO — Automatically sequences between the wideband and highband filters when measuring jitter. The JITTER OUTPUT connector is disabled with this selection.

2.72.2 JIT SCALE — Jitter Amplitude Scale Select



The JITTER-JIT SCALE auxiliary function selects one of four jitter amplitude scales to measure the jitter amplitude. Press the **RESULTS I Results** switch to select one of the following scales:

2 UI P-P — Selects the scale from 0 to 2.000 UI peak-to-peak.

5 UI P-P — Selects the scale from 0 to 5.00 UI peak-to-peak.

20 UI P-P — Selects the scale from 0 to 20.00 UI peak-to-peak.

AUTO — Automatically sets the scale to the measured amplitude. The JITTER OUTPUT connector is disabled with this selection.

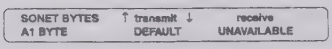
2.72.3 JIT THRSHOLD — DS3 Jitter Threshold Select

The JITTER-JIT THRSHOLD auxiliary function sets the jitter threshold for the HB JIT or WB JIT test results. When the threshold is exceeded, the test result appears in the SUMMARY category.

Select — Press the **RESULTS I Results** switch to select the desired jitter threshold as follows:

0.01 to 0.05 in 0.01 UI steps.
0.05 to 0.2 in 0.05 UI steps.
0.2 to 1.0 in 0.2 UI steps.
1.0 to 5.0 in 0.5 UI steps.
5.0 to 20.0 in 5.0 UI steps.

2.73 SONET BYTES — SONET BYTE MANIPULATION AUXILIARY GROUP



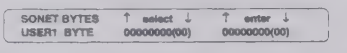
The SONET BYTES auxiliary group supports the 27 additional auxiliary functions used to display/modify the TOH (Transmission Overhead) bytes in the SONET transmission stream. This auxiliary function allows the current value of the following bytes to be displayed and modified, if desired.

Press the **PATTERN/PAYLOAD** switch to select the desired byte (SOH, LOH, or POH) for transmit.

SECTION OVERHEAD BYTES — A1, A2, F1, D1, D2, and D3.
LINE OVERHEAD BYTES — K1, K2, D4, D5, D6, D7, D8, D9, D10, D11, D12, Z1, and Z2.
PATH OVERHEAD BYTES — C2, G1, F2, Z3, Z4, and Z5.

Transmit — Press the **RESULTS I Results** switch to select the value of the selected byte. Options are: DEFAULT, AA, 55, USER 1, and USER 2.

This auxiliary function also allows the current status of the following USER1 and USER2 registers to be pre-programmed in memory, if desired. That auxiliary screen could resemble the following:



Press the **PATTERN/PAYLOAD** switch to select USER1 or USER2 for transmit.

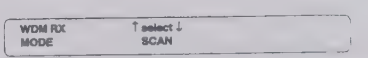
Select — Press the **RESULTS I Results** switch to select the bit to be programmed. The **RESULTS I Blank** switch allows user to toggle the values of the selected bit.

Enter — Press the **RESULTS I I Results** switch to register the program byte value in the unit.

2.74 WDM RX — WAVELENGTH DIVISION MULTIPLEXING RX AUXILIARY GROUP

The following auxiliary functions only appear when the 310-22 DWDM Channel Monitor Option is installed. The auxiliary functions allow the user to select Scan or Drop Mode, set the display for units, select a specific channel, and set the Peak Threshold or Peak Excursion.

2.74.1 MODES — WDM Receive Mode Select



The WDM RX-MODES auxiliary function selects the mode for all DWDM results and AUX functions. The user can switch from Channel Scan to Drop mode without restarting the test. The NOVRAM default is Channel Scan. Press the **RESULTS I Results** switch to select one of the following modes:

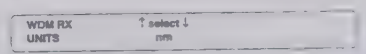
SCAN — Continuously detects channels and updates display.

DROP — Selects specified channel to be transmitted and analyzed via DWDM output connector.

NOTE

While the default mode is Scan, changing from Scan and Drop does not cause a TEST RESTART. However, changing from Drop to Scan causes a TEST RESTART.

2.74.2 UNITS — WDM Receive Units Select

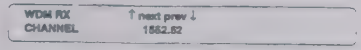


The WDM RX-UNITS auxiliary function selects the displayed measurement units for all DWDM results and AUX functions. The valid selections are wavelength basis (nm) or frequency basis (THz.) The NOVRAM default is "nm." Press the **RESULTS I Results** switch to select one of the following levels:

nm — Select for signal levels received at a wavelength basis.

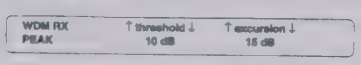
THz — Select for signal levels received at a frequency basis.

2.74.3 CHANNEL — WDM Receive Channel Select



The WDM RX-CHANNEL auxiliary function reads "scanning" after a TEST RESTART until a valid scan has been completed. If no input signal is available at the side panel input port, the T-BERD 310 remains in a "scanning" mode until a valid signal is applied. The first available channel found becomes the default. The available channel list is sorted in ascending order for "wavelength" selection, and in descending order if "frequency" is selected. Press the **RESULTS I Results** switch to scroll through detected channels.

2.74.4 WDM RX PEAK — WDM Receive Peak Threshold and Excursion Select



The WDM RX-PEAK auxiliary function defines the detection criteria for the individual DWDM channels.

Peak Threshold limit is set by subtracting the peak threshold value from the power of the largest channel. For example, if the largest channel is -2dBm and the peak threshold value is set to 10dB, then the peak threshold limit is -12dBm. Each channel must exceed the peak threshold limit. The default value for Peak Threshold is 10 dB. Press the **RESULTS I Results** switch to scroll through detected channels.

The Peak Excursion defines the rise and fall in amplitude that must take place for a channel to be recognized. The default value for Peak Excursion is 15dB. Configuration values for both Peak Threshold and Peak Excursion are stored in NOVRAM and are restored after power-up.

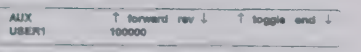
Changing Peak Threshold or Peak Excursion causes a TEST RESTART and forces WDM RX into Scan Mode.

DS1/DS0 ANALYZER OPTION AUXILIARY FUNCTIONS

2.75 INTRODUCTION

The following auxiliary functions configure the 310-1 DS1/DS0 Analyzer Option to transmit a user-programmable test pattern, transmit standard and programmable loop codes, transmit and report on ESF PRMs, control the DATAPORT connector signal, customize test result printouts, measure DS1 timing slips, scan and report on specified events, and test FT1 channels.

2.76 USER1 — USER-PROGRAMMABLE TEST PATTERN

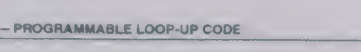


The AUX-USER1 auxiliary function programs a 3- to 24-bit user-programmable test pattern. This allows the DS1/DS0 Analyzer Option to transmit specific patterns to test circuit sensitivity. The pattern is transmitted when the USER1 pattern is selected with the **PATTERN** switch. The pattern is transmitted in left-to-right order. A test restart of the DS1/DS0 Analyzer Option occurs when the pattern is saved while the USER1 pattern is transmitted. The test pattern is programmed with the following switches:

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to 24 bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit between "1" and "0". Press the down arrow to end or save the bit pattern from the position of the cursor to the first bit on the left. Any bits to the right of the cursor are deleted when the down arrow is pressed. The pattern is saved when *end* is selected.

2.77 PGM LPUP — PROGRAMMABLE LOOP-UP CODE



The AUX-PGM LPUP auxiliary function programs a 3- to 8-bit user-defined loop-up code. This allows the DS1/DS0 Analyzer Option to transmit nonstandard loop codes. The programmed loop-up code is transmitted when the **LOOP UP** switch is pressed and the AUX-LP CODE auxiliary function is set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The loop-up code is programmed with the following switches:

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

2.78 PGM LPDN — PROGRAMMABLE LOOP-DOWN CODE

The AUX-PGM LPDN auxiliary function programs a 3- to 8-bit user-defined loop-down code. This allows the DS1/DS0 Analyzer Option to transmit nonstandard loop codes. The programmed loop-down code is transmitted when the **LOOP DOWN** switch is pressed and AUX-LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The loop-down code is programmed with the following switches.

RESULTS I Results switch — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

RESULTS II Results switch — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

2.79 LP CODE — LOOP CODE SELECT

The AUX-LP CODE auxiliary function selects the in-band (in-band or ESF out-of-band) T1 loop code transmitted when the **LOOP CODE** switches are pressed. Transmitting a loop code restarts the test. The loop code bit patterns in the following descriptions are transmitted in left-to-right order. Press the **RESULTS I Results** switch to select one of the following in-band loop codes.

CSU — The Customer Service Unit loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible CSU. The transmitted loop-up code is 10000 and the loop-down code is 100.

PROGRAMMABLE — The 3- to 8-bit programmable loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with any nonstandard device. The loop codes are programmed through the AUX-PGM LPUP and AUX-PGM LPDN auxiliary functions.

FACILITY 2 — The 5-bit facility or network (smart connector) loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible facility interface. The transmitted loop-up code is 11000 and the loop-down code is 11100.

FACILITY 1 — The 4-bit facility or network (smart connector) loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible facility interface. The transmitted loop-up code is 1100 and the loop-down code is 1110.

When the 310-9B option is installed, the ESF out-of-band loop code selection appears in the RESULTS II window.

AUX	↑ in band ↓	↑ out of band ↓
LP CODE	CSU	LINE

When the T1 ESF or optional T1 ESFz mode is selected, the ESF loop code type (in-band or out-of-band) is selected from the AUX-ESF LOOP auxiliary function. Press the **RESULTS I Results** switch to select one of the in-band loop codes. Press the **RESULTS II Results** switch to select one of the following ESF out-of-band loop codes:

LINE — The line loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0111 0000 and the loop-down code is 1111 1111 0001 1100.

PAYLOAD — The payload loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0010 1000 and the loop-down code is 1111 1111 0100 1100.

NETWORK — The network loop codes allow the DS1/DS0 Analyzer Option to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0100 1000 and the loop-down code is 1111 1111 0010 0100.

2.80 ESF LOOP — ESF LOOP CODE SELECT

AUX	↑ select ↓
ESF LOOP	IN BAND

The AUX-ESF LOOP auxiliary function selects the loop code type that is transmitted through an ESF circuit when the **LOOP CODE** switches are pressed. The specific loop code is selected through the AUX-LP CODE auxiliary function. This auxiliary function only appears when the 310-9B option is installed. Press the **RESULTS I Results** switch to select the method of transmitting the loop code:

IN BAND — The in-band loop codes (CSU, PGM, FAC1, and FAC2) are transmitted in place of the data or test pattern.

OUT OF BAND — The out-of-band loop codes (LINE, PAYLOAD, and NETWORK) are transmitted over the ESF datalink.

2.81 PRM — ESF DATALINK PERFORMANCE REPORT MESSAGE CONTROL

AUX	↑ prm transmit ↓	↑ prm rcvr ↓
PRM	OFF	ON

The AUX-PRM auxiliary function determines how the PRM is transmitted and whether the PRM results are accumulated. The auxiliary function is only active in the ESF and optional ESFz operating modes when the 310-9B option is installed. Press the **RESULTS I Results** switch to select how the PRM is transmitted from the DS1/DS0 Analyzer Option.

OFF — The PRM transmit function is disabled.

EMUL CUSTOMER — Emulates the customer PRM. Selecting EMUL CUSTOMER sets the PRM C/R bit to 0.

EMUL CARRIER — Emulates the carrier PRM. Selecting EMUL CARRIER sets the PRM C/R bit to 1.

When transmitting the PRM, the SE bit is set to 1 when the DS1/DS0 Analyzer Option detects a frame loss in the received signal; SL bit is always set to 0; and the LB bit is always set to 0.

Press the **RESULTS II Results** switch to control the PRM receiver as follows:

OFF — The PRM receiver is disabled and the DS1/DS0 Analyzer Option does not report on the PRM status.

ON — The PRM receiver is enabled and the DS1/DS0 Analyzer Option reports on the PRM status in the BPV, FRAME, and TIME categories.

2.82 DATAPORT — DATAPORT CONNECTOR OUTPUT

AUX	↑ select ↓
DATAPORT	DS0

The AUX-DATAPORT auxiliary function selects the drop output (DS0 or datalink) for the side-panel DATAPORT connector. The DATAPORT is active only when frame synchronization is achieved. Press the **RESULTS I Results** switch to select one of the following outputs:

DS0 — Provides access to the 56 or 64 kb/s DS0 channel selected with the **DS0 DROP CHANNEL** switch. The DS0 data bits can be monitored through the Data Bit LEDs or analyzed with an external test set.

DATALINK — Provides access to the ESF, optional ESFz, or SLC-96 formatted datalink output when the respective operating mode is selected. External decoding is required to separate the datalink bits from the Fs bits.

2.83 CUSTOM — CUSTOMIZED PRINTOUT CONTENTS

AUX	↑ select ↓	↑ on off ↓
CUSTOM	T1 PULSES	OFF

The AUX-CUSTOM auxiliary function selects specific DS1 results and Status and Alarm LED conditions to be included in a test results printout. Select the custom test results printout from the T-BERD 310 PRINT-FORMAT auxiliary function. Press the **RESULTS** switches to select the desired printout line items:

RESULTS I Category switch — Press this switch to select the desired category. The Status and Alarm LEDs and FEAC codes are selected from the SUMMARY category.

RESULTS I Results switch — Press this switch to select the results and LEDs. Refer to *DS1/DS0 Analyzer Option Test Results* for the available test results.

RESULTS II Results switch — Press the up arrow to toggle ON or the down arrow to toggle OFF the status condition.

2.84 SLIP REF — DS1 TIMING SLIP REFERENCE SOURCE

AUX	↑ select ↓
SLIP REF	DS1 RECEIVE

The AUX-SLIP REF auxiliary function selects the TIMING SLIPS result reference signal source. This auxiliary function only appears with the installed 310-9B option. Press the **RESULTS I Results** switch to select one of the following reference signal sources:

PRI DS3 DROP — Selects the DS1 channel that is internally dropped from the DS3 RECEIVE connector. Select the DS1 channel with the **DS3-DS1 CHANNEL CONTROL-DROP** switch.

SEC DS3 DROP — Selects the DS1 channel that is internally dropped from the SECONDARY DS3 RECEIVE connector on the DS1 Insert/Secondary DS3 Receive Option. Select the DS1 channel with the **DS3-DS1 CHANNEL CONTROL-INSERT** switch. If the **DS3-DS1 CHANNEL CONTROL-INSERT** switch is blank or displays three bars (— — —) depending on the selected mode, the **DS3-DS1 CHANNEL CONTROL-DROP** switch can select a channel for the reference signal source.

SONET DROP — Selects the DS1 channel that is dropped from the STS-1, OC-1/3/3c, OC-12, or OC-48 RECEIVE connector on a SONET option. Select the SONET DS1 channel to drop by setting the **CHANNEL CONTROL** switch to SONET- VT (for the 310-13R or 310-14R option). Do not use the **DS3-DS1 CHANNEL CONTROL-DROP** switch to select the DS1 channel.

DS1 RECEIVE — Selects the DS1 signal from the DS1 RECEIVE connector on the DS1/DS0 Analyzer Option.

DS1 INSERT — Selects the DS1 signal from DS1 INSERT INPUT connector on the DS1 Insert/Secondary DS3 Receive Option.

DS1 BITS CLOCK — Selects the DS1 signal from DS1 BITS CLOCK connector on the 310-13T or 310-14T option.

Select the DS1 test signal source with the **DS1 SOURCE** switch. Table 2-7 indicates the relationship between the test signal source and the reference signal source. Refer to the *T-BERD 310 User's Guide* for additional information on how to setup for a DS1 timing slip test.

Table 2-7. Valid DS1 Timing Slip Test Connections

Selection	Reference Signal Source Connections (selected with AUX-SLIP REF Function)	Test Signal Source (selected with DS1 SOURCE Switch)		
		DS3 DROP	SONET DROP	EXT. INPUT
PRI DS3 DROP	PRIMARY DS3 RECEIVE INPUT	—[1]	√[2]	√
SEC DS3 DROP	SECONDARY DS3 RECEIVE	√	√	√
SONET DROP	STS-1 RECEIVE	√	—	√
	OC-1/OC-3 RECEIVE	√	—	√
	OC-12 RECEIVE	√	—	√
	OC-48 RECEIVE	√	—	√
DS1 RECEIVE	DS1 RECEIVE	√	√	—
DS1 INSERT	DS1 INSERT INPUT	√	√	√
DS1 BITS CLOCK	DS1 BITS CLOCK	√	√	√

1. Same connection. The test setup is invalid.
2. √ Valid selection.

NOTE

"SAME REF" appears in the timing slips result when an invalid test is selected. "REF LOSS" appears when the reference signal is disconnected or cannot be analyzed.

2.85 SCAN TRIG — TRIGGERED DS1 SCAN MODE EVENT CRITERIA

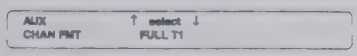
AUX	↑ select ↓	↑ on off ↓
SCAN TRIG	FRAME ERRORS	OFF

The AUX-SCAN TRIG auxiliary function selects the criterion to be scanned on the DS1 channels during a triggered DS1 scan test. When the scan mode detects a selected event, the DS1/DS0 Analyzer Option stops scanning, auto configures to the dropped signal, and performs full BER analysis. Press the **RESULTS I Results** switch to select one of the following events:

FRAME ERRORS — Frame Errors
CRC ERRORS — Cyclic Redundancy Check Errors
ALL ONES — All Ones pattern
YELLOW ALARM — Yellow Alarm
TIM SLIPS — Timing Slips (requires the 310-9B option and a reference signal source)
FRAME SYNC — Frame Synchronization
FRAME LOSS — Frame Loss

Press the **RESULTS II Results** switch to enable or disable the selected trigger event. If all of the events are disabled, the message *NO TRIGGER EVENTS SET* appears when SCAN TRIGGER is selected. At least one trigger event must be enabled to use the triggered DS1 scan test.

2.86 CHAN FMT — CHANNEL FORMAT SELECT

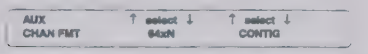


The AUX-CHAN FMT auxiliary function configures the test instrument for Fractional-T1 (FT1) testing. This auxiliary function only appears with the installed 310-9B option.

Select — Press the **RESULTS I Results** switch to select one of the following FT1 formats:

FULL T1 — Sets the test instrument to test full T1 bandwidths. All of the other operating modes can be selected.

64xN — Sets the test instrument to test contiguous or non-contiguous FT1 channels. When 64xN is selected, the RESULTS II windows displays the following selections:



CONTIG — Sets the test instrument to test contiguous FT1 channels. When CONTIG is selected, the CONTIG auxiliary function can be selected to set the base channel and bandwidth of the FT1 channel.

N-CONTIG — Sets the test instrument to test non-contiguous FT1 channels. When N-CONTIG is selected, the N-CONTIG auxiliary function can be selected to set the non-contiguous FT1 channels.

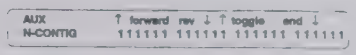
2.87 CONTIG — FT1 CONTIGUOUS CHANNEL SELECT

The AUX-CONTIG auxiliary function configures the test instrument for contiguous Fractional-T1 (FT1) testing. As the base channel is increased from 1 to 24, the FT1 channel bandwidth decreases from 24 to 1. This auxiliary function only appears with the installed 310-9B option.

Start chan — Press the **RESULTS I Results** switch to select the base channel, 1 to 24.

Length — Press the **RESULTS II Results** switch to select the FT1 channel bandwidth, 24 to 1.

2.88 N-CONTIG — FT1 NON-CONTIGUOUS CHANNEL SELECT



The AUX-N-CONTIG auxiliary function configures the test instrument for non-contiguous Fractional-T1 (FT1) testing. This auxiliary function only appears with the installed 310-9B option.

Forward/Rev — Press the **RESULTS I Results** switch up arrow to move the cursor from left to right. Press the **RESULTS I Results** switch down arrow to move the cursor from right to left.

Toggle/End — Press the **RESULTS II Results** switch up arrow to toggle the 1 to a 0 or a 0 to a 1 at the cursor location. A 1 indicates the channel is activated, and a 0 indicates the channel is disabled. Number the positions from left to right, 1 to 24. Press the **RESULTS II Results** switch down arrow to end the session and save the selected non-contiguous bandwidth.

2.89 INTRODUCTION

The primary DS3 receiver has full Bit Error Rate Test (BERT) capabilities and supports all the DS3 results defined in the following sections. Two results can be displayed at one time in the RESULTS I and RESULTS II windows. The **RESULTS I** and **RESULTS II** switches enable the categorized results to be displayed. The **RESULTS I** and **RESULTS II SECONDARY** switches are only functional when the DS1 Insert/Secondary DS3 Receive Option is installed.

The available results depend on framing type, pattern synchronization, installed options, etc. Results that are *not available* display the message *UNAVAILABLE* in place of the result count. The results that are *not applicable* to the current mode display *N/A* in place of the result count. When the displayed count exceeds 99,999,999, a ">" (greater than sign) appears in window. When the number rolls over, the count continues.

2.90 DS3 SUMMARY CATEGORY

The SUMMARY category automatically displays key results that are non-zero or out-of-specification. This allows quick access to the results without having to search through the other categories.

2.90.1 DS3 Summary Test Results

The following DS3 test results appear in the SUMMARY category when they begin to detect error conditions:

- BIT ERRORS (LOGIC category)
- SLIPS (LOGIC category)
- VIOLATIONS (BPV category)
- PAR ERRORS (PARITY category)
- C-BIT ERRORS (PARITY category)
- FEBE (PARITY category)
- FRM ERRORS (FRAME category)
- DS2 FRM ERR (FRAME category)
- RX FREQ (SIGNAL category)
- FEAC Messages

When all SUMMARY results are error-free, the message *ALL RESULTS OK* is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press either the **RESULTS I Results** switch or **RESULTS II Results** switch to scroll through the results.

- PATH FEBE — Path FEBE
- PATH UAS — Path Unavailable Seconds
- POINTER SIZE — SPE Pointer Size
- SECT BIP ERR — Section Bit Interleaved Parity Errors
- SON RX FREQ — SONET Receive Frequency
- VT BIP ERR — VT BIP Errors
- VT FEBE — VT FEBE
- VT UAS — VT Unavailable Seconds

SONET Alarms

- PATT LOSS — SONET Payload Pattern Loss
- SON BIT ERR — SONET Bit Errors

2.90.4 OC-3c and OC-12c ATM Option Summary Test Results

When the OC-3c ATM and/or OC-12c ATM Analysis Option is installed, the SUMMARY category automatically displays the ATM alarms when they exceed predefined conditions. The ATM Alarm test result displays current (C) and historical (H) signal status for the following conditions (nn = C, H, or HC):

- ATM AIS nn — ATM Alarm Indication Signal
- ATM RDI nn — ATM Remote Defect Indication
- ATM OCD (formally OUT OF SYNC) nn — Out of cell delineation
- ATM LCD (formally SYNC LOSS) nn — Loss of cell delineation
- ATM LCD FAIL (formally SYNC FAIL) nn — Loss of cell delineation failure
- ATM NO MASKD nn — No Test Mask Cells Received
- ATM ALL IDLE nn — All Idle ATM Cells Received

2.90.5 DS1 and DS3 ATM Option Summary Test Results

When the DS1/DS3 ATM Analysis Option is installed, the SUMMARY category automatically displays the ATM alarms when they exceed predefined conditions. The ATM Alarm test result displays current (C) and historical (H) signal status for the following conditions (nn = C, H, or HC):

- ATM AIS nn — ATM Alarm Indication Signal
- ATM RDI nn — ATM Remote Defect Indication
- ATM OCD (formally OUT OF SYNC) nn — Out of cell delineation
- ATM LCD (formally SYNC LOSS) nn — Loss of cell delineation
- ATM LCD FAIL (formally SYNC FAIL) nn — Loss of cell delineation failure
- ATM NO MASKD nn — No Test Mask Cells Received
- ATM ALL IDLE nn — All Idle ATM Cells Received

2.90.6 DS3 Jitter Option Summary Test Results

When the DS3 Jitter Option is installed and the JITTER JIT THRESH auxiliary function threshold is set, the SUMMARY category automatically displays the MAX WB JIT and MAX NB JIT test results when the threshold is exceeded.

2.90.2 FEAC Message and Loop Code Summary Test Results

The Far-End Alarm and Control (FEAC) messages (see Table 2-8) and loop codes (see Table 2-9) appear in the SUMMARY category under the FEAC Code result. The FEAC messages are accumulated as they are detected. Only the last FEAC loop code is stored in the FEAC Code result. The results remain in the SUMMARY category until a test restart is initiated. The messages comply with the ANSI T1.107a-1990 standard and can be transmitted using the MISC-FEAC ALARMS and MISC-FEAC LOOP auxiliary functions. They are also printed as status (loop code messages) and alarm messages.

C-BIT	FEAC Code:	BIT ERRORS
2*23-1	DS3 EF SA	0

Table 2-8. Far-End Alarm and Control Messages

Message	Description
DS1 EF SA	DS3 Equipment Failure, Service Affecting (Type 1 equipment failure)
DS3 L/H	DS3 Loss-of-Signal/High Bit Error Ratio
DS3 OOF	DS3 Out-of-Frame, Loss of DS3 Frame Synchronization
DS3 AIS RX	DS3 Alarm Indication Signal Received
DS3 IDLE RX	DS3 Idle Signal Received
DS3 EF NSA	DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)
COMM EF NSA	Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure)
MULT DS1 L/H	Multiple DS1 Loss-of-Signal/High Bit Error Ratio
DS1 EF SA	DS1 Equipment Failure, Service Affecting (Type 1 equipment failure)
SING DS1 L/H	Single DS1 Loss-of-Signal/High Bit Error Ratio
DS1 EF NSA	DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)

Table 2-9. FEAC Far-End Loop Code Messages

Message	Description
ALL DS1 LPDN	All DS1 Lines loop-down code
ALL DS1 LPUP	All DS1 Lines loop-up code
DS1 xx LPDN	DS1 Line No. xx loop-down code (xx = 1 to 28)
DS1 xx LPUP	DS1 Line No. xx loop-up code (xx = 1 to 28)
DS3 LN LPDN	DS3 Line loop down code
DS3 LN LPUP	DS3 Line loop-up code

2.90.3 SONET Option Summary Test Results

The following SONET test results appear in the SUMMARY category when the T-BERD 310 has properly recognized and synchronized to a SONET signal:

- APS MSG CNT — Automatic Protection Switching Message Count
- FRM WORD ERR — Frame Word Errors
- LINE BIP ERR — Line BIP Errors
- LINE FEBE — Line Far-End Block Errors
- LINE UAS — Line Unavailable Seconds
- PATH BIP ERR — Path BIP Errors

2.91 DS3 LOGIC CATEGORY

Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization is obtained. The results are also not available when transmitting a channelized test pattern (i.e., the operating mode is set for MUXED M13 or MUXED C-BIT). During loss of frame or pattern synchronization, the accumulation of errors is halted.

2.91.1 DS3 Test Results

The DS3 LOGIC category test results are defined in Table 2-10.

Table 2-10. DS3 LOGIC Category Test Results

Displayed Test Result	Description
BIT ERRORS	***Bit Errors*** — The number of received pattern bits which have a value opposite that of the corresponding transmitted bit pattern since initial DS3 pattern synchronization.
BIT ERR RT	***Bit Error Rate*** — The ratio of pattern bit errors to received pattern bits over the previous block of 10^9 bits.
AV BIT ERT	***Average Bit Error Rate*** — The ratio of pattern bit errors to the total number of received pattern bits while DS3 pattern synchronization is present.
BIT ERR SEC	***Bit Errored Seconds*** — The number of seconds during which one or more pattern bit errors occurred since initial DS3 pattern synchronization.
BIT %EFS	***Bit, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while DS3 pattern synchronization is present.
BIT THR ES	***Bit, Threshold Errored Seconds*** — The number of seconds during which the pattern bit error rate exceeded or equaled the user-defined threshold. The threshold is set through the ERR RECEIVE-ERROR THR auxiliary function.
SYNC ES	***Synchronous Errored Seconds*** — The number of seconds during which at least one pattern bit error has occurred. Each second is measured by, and synchronized to, a pattern bit error.
SYNC L SEC	***Synchronization Loss Seconds*** — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS3 pattern synchronization.
SLIPS	***Slips*** — The number of times the received pattern becomes skewed relative to the expected (i.e., internally generated) test pattern. When a slip is detected, the T-BERD 310 momentarily resynchronizes to the received pattern. However, pattern bit errors are not suppressed during this process. Pattern slips are available only when using pseudorandom patterns.

2.91.2 G.821 Results Option Test Results

The G.821 Results Option enables the T-BERD 310 to evaluate the long-term performance of your system. The option adds eight performance analysis results to the LOGIC category. The G.821 performance results are defined in Table 2-11.

Table 2-11. DS3 G.821 Results Option LOGIC Category Test Results

Displayed Test Result	Description
AVAIL SEC	***Available Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is less than 10^{-3}.
%AVAIL SEC	***% Available Seconds*** — The ratio, expressed as a percentage, of available seconds to the total elapsed seconds since pattern synchronization.
SEV ERR SEC	***Severely Errored Seconds*** — A count of seconds during which the bit error rate is worse than 10^{-3} within the available time.
%SEVERR SEC	***% Severely Errored Seconds*** — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.
CSES	***Consecutive Severely Errored Seconds*** — A count of three or more contiguous severely errored seconds in which a bit error rate worse than 10^{-3} in each second.
DEG MIN	***Degraded Minutes*** — A count of minutes during which the bit error ratio is worse than 10^{-6} and less than 10^{-3}.
%DEG MIN	***% Degraded Minutes*** — The ratio, expressed as a percentage, of degraded minutes to the number of available non-severely errored minutes.
UNAVAIL SEC	***Unavailable Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is greater than or equal to 10^{-3}.

The G.821 results are only available after gaining initial pattern synchronization in any DS3 framing mode except MUXED M13, MUXED C-BIT, and AUTO when live data is transmitted. After gaining initial pattern synchronization from the DS3 RECEIVE connector, the G.821 results, except for the degraded minute results, are directly affected by signal, frame, and pattern loss. When DS3 pattern synchronization is achieved from a SONET source, the G.821 results, except for the degraded minute results, are directly affected by the SONET signal and frame loss.

ITU-T Recommendation G.821 defines available and unavailable time as follows:

> A period of unavailable time begins when the bit error rate in each second is worse than 10^{-3} for 10 consecutive seconds. These 10 seconds are considered to be unavailable time. The period of unavailable time terminates when the bit error rate in each second is better than 10^{-3} for 10 consecutive seconds. These 10 seconds are considered to be available time.

Available and unavailable times are measured in seconds — available seconds (AVAIL SEC) and unavailable seconds (UNAVAIL SEC), respectively. All test seconds must fall into one of the two categories (total available seconds + total unavailable seconds = total test seconds).

At the beginning of a test, test seconds are considered to be available time; the available seconds begin counting. These seconds continue to be counted until 10 consecutive seconds occur each with a bit error rate worse than 10^{-3}. A sliding window, 10 seconds in length, is used to detect this transition from available to unavailable time and vice versa.

Degraded minutes (DEG MIN) is an error analysis result that is affected by available and unavailable time. DEG MIN is a count of the number of minutes during which an average bit error rate worse than 10^{-6}, but better than 10^{-3}, occurs. The 1-minute intervals are derived by removing unavailable seconds and severely error seconds from the total test time and then consecutively grouping the remaining seconds into blocks of 60. The average bit error rate is calculated for the block of 60 seconds and, if it is worse than 10^{-6}, the block is counted as a degraded minute.

In the transition from available time to unavailable time, the DEG MIN result is unaffected. This is because a switch to unavailable time requires 10 consecutive seconds each with a bit error rate worse than 10^{-3}. Any second in available time with a bit error rate worse than 10^{-3} is considered to be a severely errored second and, therefore, is not included in the accumulation of seconds used to calculate degraded minutes.

Moving from unavailable time to available time may affect the DEG MIN count. While in unavailable time, 10 consecutive seconds each with a bit error rate better than 10^{-3} are required for the transition to available time. When this happens, those 10 seconds are subtracted from the UNAVAIL SEC count and are added to the available seconds count. Since these seconds are now considered to be a part of available time and they are not severely errored seconds, they are included in the calculation of degraded minutes.

2.92 DS3 BPV CATEGORY

Bipolar violations are caused by successive DS3 pulses with the same polarity being detected (except those pulses that are part of the B3ZS encoding). Bipolar violation results are only accumulated when the signal is present. The BPV category results are defined in Table 2-12.

Table 2-12. DS3 BPV Category Test Results

Displayed Test Result	Description
VIOLATIONS	***Bipolar Violations*** — The number of bipolar violations (BPVs) detected since detecting the signal. Intentional B3ZS code violations are excluded from the count.
BPV ERR RT	***BPV Error Rate*** — The ratio of BPVs to received bits over the previous block of 10^8 bits.
AV BPV ERT	***Average BPV Error Rate*** — The ratio of BPVs to the total number of received bits since detecting the signal.
BPV ERR SEC	***BPV Errored Seconds*** — The number of seconds during which one or more BPVs occurred since detecting the signal.
BPV %EFS	***BPV, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no BPVs were detected, to the total number of seconds since detecting the signal.
BPV THR ES	***BPV Threshold Errored Seconds*** — The number of seconds during which the BPV rate exceeded or equaled the user-defined threshold. The threshold is set through the ERR RECEIVE-ERROR THR auxiliary function.

2.93 DS3 PARITY CATEGORY

The DS3 PARITY category results depend on the current framing mode and the received framing signal. The PARITY category results are defined in Table 2-13.

Table 2-13. DS3 PARITY Category Test Results

Displayed Test Result	Description
PAR ERRORS	***Parity (P-bit) Errors*** — The number of parity errors detected since initial DS3 frame synchronization.
PAR ERR RT	***Parity (P-bit) Error Rate*** — The ratio of parity errors to (1) the number of bits over which parity was calculated (Bit mode), or (2) the number of DS3 M-frames received (Block mode). The error rate is computed over the previous block of 10^8 bits. The result is derived as a bit or block error rate based on the setting of ERR RECEIVE-PAR ERR RT auxiliary function.
AV PAR ERT	***Average Parity (P-bit) Error Rate*** — The ratio of parity errors to (1) the number of bits over which parity was calculated (Bit mode), or (2) the number of DS3 M-frames received (Block mode). The error rate is computed while DS3 frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.
PAR ERR SEC	***Parity (P-bit) Errored Seconds*** — The number of seconds during which one or more parity errors occurred since initial DS3 frame synchronization.
PAR %EFS	***Parity (P-bit), Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no parity errors were detected, to the total number of seconds while DS3 frame synchronization is present.
C-BIT ERRORS	***C-bit Parity Errors*** — The number of parity errors detected since initial DS3 C-bit frame synchronization.
C-BIT ERR RT	***C-bit Parity Error Rate*** — The ratio of C-bit parity errors to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of 10^8 bits. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.
AV C-BIT ERT	***Average C-bit Parity Error Rate*** — The ratio of C-bit parity errors to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed while DS3 C-bit frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.
C-BIT TYPE A	***C-bit Parity Errored Seconds, Type A*** — The number of seconds during which one and only one C-bit parity error occurred since initial DS3 C-bit frame synchronization.
C-BIT TYPE B	***C-bit Parity Errored Seconds, Type B*** — The number of seconds during which 2 to 44 C-bit parity errors occurred since initial DS3 C-bit frame synchronization.
C-BIT TYPE C	***C-bit Parity Errored Seconds, Type C*** — The number of seconds during which more than 44 C-bit parity errors occurred since initial DS3 C-bit frame synchronization.
C-BIT %EFS	***C-bit Parity, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no C-bit parity errors were detected, to the total number of seconds while DS3 C-bit frame synchronization is present.
FEBE	***Far-End Block Errors*** — The number of far-end block errors (FEBEs) detected since initial DS3 C-bit frame synchronization.
FEBE RT	***Far-End Block Error Rate*** — The ratio of FEBEs to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of 10^8 bits. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.
AV FEBE RT	***Average Far-End Block Error Rate*** — The ratio of FEBEs to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed while DS3 C-bit frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.
FEBE TYPE A	***Far-End Block Errored Seconds, Type A*** — The number of seconds during which one and only one FEBE occurred since initial DS3 C-bit frame synchronization.

Table 2-13. DS3 PARITY Category Test Results (Continued)

Displayed Test Result	Description
FEBE TYPE B	***Far-End Block Errored Seconds, Type B*** — The number of seconds during which 2 to 44 FEBEs occurred since initial DS3 C-bit frame synchronization.
FEBE TYPE C	***Far-End Block Errored Seconds, Type C*** — The number of seconds during which more than 44 FEBEs occurred since initial DS3 C-bit frame synchronization.
FEBE %EFS	***Far-End Block Error, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no FEBEs were detected, to the total number of seconds while DS3 C-bit frame synchronization is present.

2.94 DS3 FRAME CATEGORY

Frame errors are based on counting framing bits and identifying frame errors in the incoming DS3 signal after initial frame synchronization. The results are available whenever the receiver detects a valid M13 or C-bit parity framed signal, regardless of the transmitter framing mode. The FRAME category results are defined in Table 2-14.

Table 2-14. DS3 FRAME Category Test Results

Displayed Test Result	Description
FRM ERRORS	***Frame Errors*** — The number of frame errors detected since initial DS3 frame synchronization.
FRM ERR RT	***Frame Error Rate*** — The ratio of frame errors to received framing bits over the previous block of 10^8 bits.
AV FRM ERT	***Average Frame Error Rate*** — The ratio of frame errors to the total number of received framing bits while DS3 frame synchronization is present.
FRM ERR SEC	***Frame Errored Seconds*** — The number of seconds during which one or more frame errors occurred since initial DS3 frame synchronization.
FRM %EFS	***Frame, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no frame errors were detected, to the total number of seconds while DS3 frame synchronization is present.
FRM THR ES	***Frame Threshold Errored Seconds*** — The number of seconds during which the frame error rate exceeded or equaled the user-defined threshold. The threshold is set through the ERR RECEIVE-ERROR THR auxiliary function.
FEOOF SEC	***Far-End Out-of-Frame Seconds*** — The number of seconds during which the received X-bits are zero within the 1 second interval.
NEOOF SEC	***Near-End Out-of-Frame Seconds*** — The number of seconds during which an out-of-frame condition or an AIS is detected.
DS2 FRM ERR	***DS2 Frame Errors*** — The number of DS2 frame errors detected since initial DS2 frame synchronization. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the selected dropped channel is changed such that the new channel being dropped corresponds to a different DS2 signal. Table 2-15 identifies the DS2 channels and the corresponding DS1 channels.
DS2 FRM ERT	***DS2 Frame Error Rate*** — The ratio of detected DS2 frame errors to the total DS2 framing bits received. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the selected dropped DS1 channel is changed such that the new channel being dropped corresponds to a different DS2 signal. Table 2-15 identifies the DS2 channels and the corresponding DS1 channels.
DS2 AV F ERT	***DS2 Average Frame Error Rate*** — The ratio of DS2 frame errors to the total number of received framing bits while DS2 frame synchronization is present.

Table 2-14. DS3 FRAME Category Test Results (Continued)

Displayed Test Result	Description
TX X BIT	***Transmitted X-bit*** — The current setting of the transmitted X-bits when in a framed mode. The transmitted X-bits are set through the MISC-TX X-BIT auxiliary function.
RX X-BIT	***Received X-bit*** — The current status of the received X-bits when in a framed mode. The result is available after receiving DS3 frame synchronization.
FRM LOSS CNT	***DS3 Frame Loss Count*** — The number of DS3 frame losses occurring after initial frame synchronization.

Table 2-15. DS2 Channels vs. Dropped DS1 Channels

Signal	Channels						
DS2	1	2	3	4	5	6	7
DS1	1-4	5-8	9-12	13-16	17-20	21-24	25-28

2.95 DS3 SIGNAL CATEGORY

The DS3 SIGNAL category results include signal loss seconds, frequency, power, level, and pulse shape measurements. If the DS3 Jitter Option is installed, jitter amplitude results are also included in the SIGNAL category. The results are accumulated after initial signal detection.

2.95.1 DS3 Test Results

The DS1/DS3 SIGNAL category test results are defined in Table 2-16.

Table 2-16. DS3 SIGNAL Category Test Results

Displayed Test Results	Description
SIG L SEC	***Signal Loss Seconds*** — The number of seconds during which the received DS3 signal was lost for all or part of a second since initial signal detection.
TX FREQ	***Transmit Frequency*** — The frequency of the transmit clock measured in Hz.
RX FREQ	***Receive Frequency*** — The frequency of the clock recovered from the received data measured in Hz.
POWER	***Receive Signal Power*** — The power level of the received DS3 signal measured in dBm.
LEVEL	***Receive Signal Level*** — The level of the received DS3 signal in volts peak.
RX LVL dBdsx	***Receive Signal Level in dBdsx*** — The level of the received DS3 signal in dBdsx. This measurement provides a simplified, reliable result, relative to the signal level. The optimal value is 0 dBdsx at the "OUT" point of a DSX-3 patch panel. *TOO LOW* and *TOO HIGH* appear when the signal level is out of range.
PULSE SHAPE	***Pulse Shape*** — A PASS/FAIL result which shows whether the DS3 pulse shape is within the specified pulse mask boundary. The pulse shape mask is set through the MISC-PULSE MASK auxiliary function. *UNAVAILABLE* appears if the T-BERD 310 has not received enough isolated pulses to measure the pulse shape (*DENSITY ERR* appears in the other pulse shape results). *N/A* appears when the pulse shape mask is not selected.

Table 2-16. DS3 SIGNAL Category Test Results (Continued)

Displayed Test Results	Description
PULSE WIDTH	***Pulse Width*** — The pulse width of the DS3 pulse measured in nanoseconds.
RISE TIME	***Pulse Rise Time*** — The time interval between the 10% and 90% points of the rising edge of the DS3 pulse measured in nanoseconds.
FALL TIME	***Pulse Fall Time*** — The time interval between the 10% and 90% points of the falling edge of the DS3 pulse measured in nanoseconds.

NOTE

The pulse shape test results (PULSE WIDTH, RISE TIME, and FALL TIME) require isolated pulses to properly measure the pulse shape against a pulse shape mask. If these results display *DENSITY ERR*, the received signal does not contain enough isolated pulses to measure the pulse shape.

2.95.2 WDM RX Option Test Results

The DS3 SIGNAL category WDM RX Option test results are defined in Table 2-17. *UNAVAILABLE* appears after a TEST RESTART until optical power is detected at the side panel input. When a scan begins, the result message changes to "scanning" until the scan is complete.

Table 2-17. WDM RX Option Category Test Results

Displayed Test Results	Description
WDM CHANNEL	***WDM Channels*** — The number of active channels detected during the last DWDM scan. It is capable of detecting up to 128 channels.
WDM AVG WAVE	***WDM Average Wavelength*** — The average measured wavelength during the last WDM scan measured in nm. Resolution of 0.01 nm is supportable. If changed to Drop Mode during a test RESTART, the display window shows *UNAVAILABLE* as the result.
WDM AVG FREQ	***WDM Average Frequency*** — The average measured frequency during the last WDM scan measured in Thz. Resolution of 0.001 nm is supportable. If changed to Drop Mode during a test RESTART, the display window shows *UNAVAILABLE* as the result.
WDM TOT POWER	***WDM Total Power*** — The WDM Total Power indicates the summation of individual channel power measurements collected during the last DWDM scan measured in dBm. If changed to Drop Mode during a test RESTART, the display window shows unavailable as the result.
WDM CHAN WAVE	***WDM Channel Center Wavelength*** — The center wavelength for the selected DWDM channel. The channel selection is made in the WDM RX CHANNEL SELECT AUX function, and it is valid for both Scan Mode and Drop Mode (appears only when nm is selected from WDM Rx UNITS).
WDM CHAN FREQ	***WDM Channel Center Frequency*** — The center frequency for the selected DWDM channel. The channel selection is made in the WDM RX CHANNEL SELECT AUX function, and it is valid for both Scan Mode and Drop Mode (appears only when nm is selected from WDM Rx UNITS)
WDM CHAN POWER	***WDM Channel Power*** — The DWDM Channel Power indicates the optical power measurements collected during the current DWDM scan measured in dBm. Resolution is 0.1dBm. The maximum value is 25.0 dBm and the minimum value is -60.0 dBm.
WDM CHAN SNR	***WDM Signal-to-Noise Ratio*** — The DWDM Channel SNR result indicates the signal-to-noise ratio for the selected DWDM channel. The channel selection is made in the WDM RX CHANNEL SELECT AUX function, and it is valid only in Scan Modes. When in Drop Mode, the result displays "(drop)". If changed to Drop Mode during a test RESTART, the display window shows unavailable as the result.

2.95.3 DS3 Jitter Option Test Results

The following DS3 Jitter Option test results (see Table 2-18) enable the T-BERD 310 to measure wideband and highband jitter as well as maximum wideband and highband jitter.

Table 2-18. DS3 Jitter Option Test Results

Displayed Test Result	Description
WB JITTER	***Wideband Jitter*** – The current wideband (10 Hz to 400 kHz) jitter amplitude, expressed in peak-to-peak UIs. This result is only available in the jitter AUTO and WIDEBAND filter modes.
MAX WB JIT	***Maximum Wideband Jitter*** — The maximum peak-to-peak wideband jitter amplitude, expressed in peak-to-peak UIs, since initial signal presence or test restart. This result is only available in the jitter AUTO and WIDEBAND filter modes. This result is unavailable if the WB JITTER result has been out of range since test restart. If the WB JITTER result is available and then goes *OUT OF RANGE*, this result also goes *OUT OF RANGE* indicating the peak jitter reading is outside the current range.
HB JITTER	***Highband Jitter*** – The current highband (30 kHz to 400 kHz) jitter amplitude, expressed in peak-to-peak UIs. This result is only available in the jitter AUTO and HIGHBAND filter modes.
MAX HB JIT	***Maximum Highband Jitter*** — The maximum peak-to-peak highband jitter amplitude, expressed in peak-to-peak UIs, since initial signal presence or test restart. This result is only available in the jitter AUTO and HIGHBAND filter modes. This result is unavailable if the HB JITTER result has been out of range since test restart. If the HB JITTER result is available and then goes *OUT OF RANGE*, this result also goes *OUT OF RANGE* indicating the peak jitter reading is outside the current range.

2.95.4 Optical Media Test Option Test Results

Table 2-19 lists the Optical Media Test Option test results which enable the T-BERD 310 to measure optical power and return loss from a fiber optic cable.

Table 2-19. Optical Media Test Option Test Results

Displayed Test Result	Description
OPTICAL PWR	***Optical Power*** — Measures optical power at the POWER METER connector. Set wavelength with the OPTICAL TEST-OPTICAL PWR auxiliary function.
RETURN LOSS	***Optical Return Loss*** — Measures optical return loss at the RETURN LOSS/SOURCE connector. Set type of measurement performed with the OPTICAL TEST-RETURN LOSS auxiliary function. Select return loss function and wavelength with the OPTICAL TEST-STABLE SOURCE auxiliary function.

2.96 DS3 TIME CATEGORY

The DS3 TIME category test results are defined in Table 2-20.

Table 2-20. DS3 TIME Category Test Results

Displayed Test Result	Description
TIME	***Current Time of Day*** — The current time of day in hours, minutes, and seconds. The time is set through the TIME SET TIME auxiliary function.
DATE	***Current Date*** — The current day and month. The date is set through the TIME-SET DATE auxiliary function.
ELAPSED TIME	***Elapsed Time*** — The elapsed time in hours, minutes, and seconds since the last test restart. If no DS3 signal is present after test restart, the test will not begin.
TEST LENGTH	***Timed Test Length*** — The currently set test length for a timed test in hours and minutes. The test length is set through the TIME-TEST LENGTH auxiliary function. This result is N/A unless the TIME-TEST auxiliary function is set to TIMED.
TIME LEFT	***Timed Test Time Left*** — The time remaining for a timed test in hours, minutes, and seconds. This result is N/A unless the TIME-TEST auxiliary function is set to TIMED.

2.97 SONET SECTION CATEGORY

Table 2-21 defines the SONET Section overhead test results which enable the T-BERD 310 to analyze the SONET Section of a network. The results are only available when a SONET RX option is installed.

Table 2-21. SONET Section Overhead Category Test Results

Displayed Test Result	Description
FRM WORD ERR	***Frame Word Errors*** — Counts the number of errored frame alignment signal (FAS) words (bytes A1 and A2) received since gaining initial frame synchronization.
SON SEF SEC	***SONET Severely Errored Frame Seconds*** — Counts the number of seconds in which one or more out of frame (OOF) alarms have occurred since gaining initial frame synchronization. A severely errored frame (SEF) is defined as four consecutive STS-N frames received with errored frame words. An OOF is defined as SEFs persisting for 3 ms or a loss of signal (LOS) occurrence.
SON LOS SEC	***SONET Loss of Signal Seconds*** — Counts the number of seconds in which one or more SONET loss of signal (LOS) events occur. An LOS is defined as an all zeros pattern which lasts for at least 100 microseconds. An LOS is removed after two consecutive valid frame alignment signals are detected without an intervening loss of signal.
SON RX FREQ	***SONET Receive Frequency*** — Displays the recovered clock frequency of the received SONET signal in hertz.
SON TX FREQ	***SONET Transmit Frequency*** — Displays the frequency of the transmitted SONET signal in hertz.
SECT BIP BER	***Section BIP Errors*** — Counts the number of times the Section BIP byte (B1) indicates an error in the previous frame since test restart. Up to eight section BIP errors can be counted in a single frame.
SECT EQU BER	***Section Equivalent Bit Error Rate*** — Presents an equivalent Section bit error rate (BER) which is derived from the received section BIP error count since initial SONET frame synchronization.
SECT BIP ES	***Section BIP Errored Seconds*** — Counts the number of seconds in which one or more Section BIP errors occurred since test restart. The errored second interval is not synchronous to the occurrence of the BIP error.

Table 2-21. SONET Section Overhead Category Test Results (Continued)

Displayed Test Result	Description
SECT BIP ESA	***Section BIP Errored Seconds, Type A*** — Counts the number of seconds in which exactly one Section BIP error occurred, and no LOF or LOS alarms occurred.
SECT BIP ESB	***Section BIP Errored Seconds, Type B*** — Counts the number of seconds in which more than one but less than 2500 Section BIP errors occurred for an STS-1, OC-1, or OC-3 signal; or less than 8800 occurred for an OC-12 or OC-48 signal.
SECT BIP SES	***Section BIP Severely Errored Seconds*** — Counts the number of seconds in which more than 2500 Section BIP errors occurred for an STS-1, OC-1, or OC-3 signal; or more than 8800 occurred for an OC-12 or OC-48 signal.

2.98 SONET LINE CATEGORY

Table 2-22 defines the SONET Line overhead test results which enable the T-BERD 310 to analyze the SONET Line of a network. The results are only available when a SONET RX option is installed.

Table 2-22. SONET Line Overhead Category Test Results

Displayed Test Result	Description
LINE BIP ERR	***Line BIP Errors*** — Counts the number of times in which the Line BIP byte (B2) indicates an error in the previous frame since initial SONET frame synchronization. Up to eight Line BIP errors can be counted in a single frame.
LINE EQU BER	***Line Equivalent Bit Error Rate*** — Presents an equivalent Line BER which is derived from the received Line BIP error count since initial SONET frame synchronization.
LINE BIP ES	***Line BIP Errored Seconds*** — Counts the number of seconds in which one or more Line BIP errors occurred since initial SONET frame synchronization. The errored second interval is not synchronous to the occurrence of the BIP error.
LINE BIP ESA	***Line BIP Errored Seconds, Type A*** — Counts the number of seconds in which exactly one Line BIP error occurred, and no LOF or LOS alarms occurred.
LINE BIP ESB	***Line BIP Errored Seconds, Type B*** — Counts the number of seconds in which more than one but less than 2500 Line BIP errors occurred for an STS-1, OC-1, or OC-3 signal; or less than 10,000 errors occurred for an OC-12 or OC-48 signal.
LINE BIP SES	***Line BIP Severely Errored Seconds*** — Counts the number of seconds in which more than 2500 Line BIP errors occurred in 1 second for an STS-1, OC-1, or OC-3 signal; or more than 10,000 errors occurred for an OC-12 or OC-48 signal.
LINE UAS	***Line Unavailable Seconds*** — Counts the number of seconds in which the line is not available based on counts of consecutive line severely errored seconds, or the presence of an AIS alarm.
APS CONFIG	***APS Configuration*** — Presents the current APS configuration: 1:n verses 1+1, and bidirectional verses unidirectional. This information is obtained from the APS line overhead byte (K2). Table 2-23 lists the possible APS configuration messages. The Mode appears on the left half of the result window, and Switching appears on the right half.
APS INFO	***APS Information*** — Presents the current protection switch request message and channel as indicated by the line overhead byte (K1). The displayed messages are listed in Table 2-24. ## is the channel number from 0 to 15. Since the APS data bytes (K1 and K2) may change rapidly during a protection switch operation, the display may not indicate every transition.
APS MSG CNT	***APS Message Count*** — Counts the number of transitions occurring in the switch priority field of the line overhead byte (K1), Bits 1 to 4. This is an indication of protection switch activity; it is not a direct count of protection switches.
LINE AIS SEC	***Line AIS Seconds*** — Counts the number of seconds in which one or more line AIS alarms occurred.

Table 2-22. SONET Line Overhead Category Test Results (Continued)

Displayed Test Result	Description
LINE FEBE	***Line FEBE*** — Counts the line FEBEs detected. Line far-end block errors are defined in the Z2 byte for any SONET rate except for STS-1 and OC-1 in the T-BERD 310.
LINE FEBE RT	***Line FEBE Rate*** — Presents an equivalent BER based on received line FEBE counts. This test result is available for any SONET rate except for STS-1 and OC-1 in the T-BERD 310.
POINTER JUST	***Pointer Justifications*** — Counts the number of times the synchronous payload envelope (SPE) pointer changed since initial SONET frame synchronization.
POINTER INC	***Pointer Increments*** — Counts the number of times the pointer bytes (H1 and H2) indicated an increment to the path payload pointer since initial SONET frame synchronization.
POINTER DEC	***Pointer Decrements*** — Counts the number of times the pointer bytes (H1 and H2) indicated a decrement to the path payload pointer since initial SONET frame synchronization.
POINTER NDF	***Pointer New Data Flags*** — Counts the number of times the pointer bytes (H1 and H2) indicated an active new data flag (arbitrary change in pointer) since initial SONET frame synchronization. An active NDF occurs during a change in payload content, or after an AIS or some other failure condition. If a change in the pointer is detected for three consecutive frames, the change is counted as an NDF, even if the pointer never has an active NDF.
POINTER DATA	***Pointer Data*** - Presents the current STS path pointer value from 0 to 782. *UNAVAILABLE* appears under a number of error conditions, such as line AIS, etc. *OUT OF RANGE* appears if the pointer value is outside 0 to 782.
POINTER SIZE	***Pointer Size Bits*** — Indicates the binary setting of the size bits in the SONET H1 byte. The normal setting for the pointer size bits is 00 to indicate a SONET payload. If the received bits are other than 00, the result appears in the SUMMARY category.
SYNC MSG	***Z1 Byte Synchronization Message*** — Displays the Z1 byte message after SONET frame synchronization and signal presence are detected. The test result displays the following Z1 byte messages: ***20 PPM CLK*** — A 20 parts per million based clock is being used. ***RESERVED*** — The received Z1 byte is reserved for other purposes. ***STRATUM 1*** — A Stratum 1 based clock is being used. ***STRATUM 2*** — A Stratum 2 based clock is being used. ***STRATUM 3*** — A Stratum 3 based clock is being used. ***TRACE UNKN*** — Traceability is unknown. ***UNKNOWN*** — Any byte other than the above. ***DO NOT USE*** — The timing source should not be used for synchronization, as it would cause a timing loop.

Table 2-23. SONET APS Configuration Result Message

Message	Switch Request
Mode	
1:n	Provisioned for 1:n mode
1+1	Provisioned for 1+1 mode
Switching	
BIDIR	Provisioned for Bidirectional Switching
UNIDIR	Provisioned for Unidirectional Switching
AIS	Line AIS
RDI	Line RDI

Table 2-24. SONET APS Information Result Messages

Message	Switch Request
## LOCKOUT	Lockout of Protection
## FORCE SW	Forced Switch
## SIG FAILH	Signal Fail High-priority
## SIG FAILL	Signal Fail Low-priority
## SIG DEGRH	Signal Degrade High-priority
## SIG DEGRL	Signal Degrade Low-priority
## MANUAL SW	Manual Switch
## WTR	Wait to Restore
## EXERCISE	Exerciser
## REVERSE	Reverse Request
## NO REVERT	Do Not Revert
## NO REQ	No Request

2.99 SONET PATH CATEGORY

Table 2-25 defines the SONET Path overhead test results which enable the T-BERD 310 to analyze the SONET Path of a network. The results are only available when a SONET RX option is installed.

Table 2-25. SONET Path Overhead Category Test Results

Displayed Test Result	Description
PATH BIP ERR	***Path BIP Errors*** — Counts the number of times in which the Path BIP byte (B3) indicates an error in the previous frame since initial SONET frame synchronization. Up to eight Path BIP errors can be counted in a single frame.
PATH EQU BER	***Path Equivalent Bit Error Rate*** — Presents an equivalent Path BER which is derived from the received Path BIP error count since initial SONET frame synchronization.
PATH BIP ES	***Path BIP Errored Seconds*** — Counts the number of seconds in which one or more Path BIP errors occurred since initial SONET frame synchronization. The errored second interval is not synchronous to the occurrence of the BIP error.
PATH BIP ESA	***Path BIP Errored Seconds, Type A*** — Counts the number of seconds in which exactly one Path BIP error occurred, and no LOF or LOS alarms occurred.
PATH BIP ESB	***Path BIP Errored Seconds, Type B*** — Counts the number of seconds in which more than one but less than 2400 Path BIP errors occurred.
PATH BIP SES	***Path BIP Severely Errored Seconds*** — Counts the number of seconds in which 2400 or more Path BIP errors occurred since initial SONET frame synchronization.
PATH UAS	***Path Unavailable Seconds*** — Counts the number of seconds in which the path is considered unavailable. The path becomes unavailable when 10 consecutive severely errored seconds occur, and these 10 seconds are included in the unavailable time. The path becomes available after 10 consecutive seconds occur without any severely errored seconds. These non-severely errored seconds are excluded from the unavailable time.
PATH AIS SEC	***Path AIS/LOP Seconds*** — Counts the number of seconds in which one or more Path AIS or LOP occurs.
PATH FEBE	***Path FEBE*** — Counts the number of Path BIP errors detected by the downstream PTE.
PATH FEBE RT	***Path FEBE Rate*** — Presents an equivalent BER based on received Path FEBE counts.

Table 2-25. SONET Path Overhead Category Test Results (Continued)

Displayed Test Result	Description
PATH TRACE	***Path Trace Message*** — Displays the 64-byte path trace ASCII message which is carried in the path overhead byte (J1). The message scrolls across the results window in a ticker tape fashion, 12 characters at a time.
SIGNAL LABEL	***Signal Label*** — Presents the payload type being carried in the current position of the current STS. The information is derived from the Path signal label (C2) and VT overhead (V5) bytes. Any C2/V5 combinations which cannot be decoded appear as *UNRECOGNIZED*. Table 2-26 lists the signal label messages. The V5 byte for VT1.5 payloads is fully decoded. For other virtual tributary sizes (VT2, VT3, and VT6), only the floating/locked indication and size are shown.
SON BIT ERR	***SONET Bit Errors*** — The number of received pattern bits which have a value opposite that of the corresponding transmitted bit pattern since initial SONET payload pattern synchronization. (Only applicable for the SONET PRBS test patterns.)
SON BIT ERT	***SONET Bit Error Rate*** — The ratio of pattern bit errors to the received pattern bits over the previous SPE frame. (Only applicable for the SONET PRBS test patterns.)
SONET STATUS	***SONET Status*** — Identifies the SONET payload pattern synchronization status. UNAVAILABLE appears when initial pattern synchronization has not been established. PATT SYNC appears when pattern synchronization has been established (83 consecutive error free bits in the PRBS pattern). PATT LOSS appears when pattern synchronization is lost after initial pattern synchronization (1024 errors in 32,767 bits). N/A appears when the result does not apply to the current test setup; received payload is not 2^31-1 (48c), [2^31-1 (48c), 2^23-1 (48c), [2^23-1 (48c), 2^23-1 (12c), [2^23-1 (12c), [2^23-1 (3c), [2^23-1 (3c). (Only applicable for the SONET PRBS test patterns.)

Table 2-26. SONET Signal Label Result Messages

Displayed Name	Description
DS4NA	DS4 North American (139.264 Mb/s)
ATM	Asynchronous Transfer Mode
DQDB	Distributed Queue Dual Bus (MAN)
DS1 ASYN	DS1 Asynchronous
DS1 ASYN L	DS1 Asynchronous, Locked Mode
DS1 BIT	DS1 Bit Synchronous
DS1 BIT L	DS1 Bit Synchronous, Locked Mode
DS1 BYTE	DS1 Byte Synchronous
DS1 BYTE L	DS1 Byte Synchronous, Locked Mode
DS3 ASYN	Asynchronous DS3
FDDI	Fiber Distributed Data Interface
PATH EQNS	Path Equipped Nonspecific
PATH UNEQ	Path Unequipped
SYNTRAN	Byte Observable SYNTRAN
UNKNOWN_xxx	Undecodable: xxx is the numeric value of the C2 byte
VT1.5 EQNS L	VT1.5 Equipped Nonspecific, Locked Mode
VT1.5 EQNS	VT1.5 Equipped Nonspecific
VT1.5 UNAS L	VT1.5 Unassigned, Locked Mode
VT1.5 UNAS	VT1.5 Unassigned
VT1.5 UNEQ L	VT1.5 Unequipped, Locked Mode
VT1.5 UNEQ	VT1.5 Unequipped

Table 2-26. SONET Signal Label Result Messages (Continued)

Displayed Name	Description
VT2 L	VT2, Locked Mode
VT2	VT2
VT3 L	VT3, Locked Mode
VT3	VT3
VT6 L	VT6, Locked Mode
VT6	VT6

2.100 SONET VIRTUAL TRIBUTARY (VT) CATEGORY

Table 2-27 defines the SONET Virtual Tributary overhead test results which enable the T-BERD 310 to analyze the SONET VT of a network. The results are only available when a SONET RX option is installed.

Table 2-27. SONET Virtual Tributary Overhead Category Test Results

Displayed Test Result	Description
VT BIP ERR	***VT BIP Errors*** — Counts the number of times in which the VT BIP byte (V5, Bits 1 and 2) indicates an error in the received signal. A maximum of two VT BIP errors can be counted in each SONET frame.
VT EQU BER	***VT Equivalent Bit Error Rate*** — Presents an equivalent VT BER which is derived from the received VT BIP error count since initial SONET frame synchronization.
VT BIP ES	***VT BIP Errored Seconds*** — Counts the number of seconds in which one or more VT BIP errors, an AIS, or VT LOP occurred.
VT BIP ESA	***VT BIP Errored Seconds, Type A*** — Counts the number of seconds in which exactly one VT BIP error occurred.
VT BIP ESB	***VT BIP Errored Seconds, Type B*** — Counts the number of seconds in which more than one but less than 600 VT BIP errors occurred.
VT BIP SES	***VT BIP Severely Errored Seconds*** — Counts the number of seconds in which 600 or more VT BIP errors occurred during a single second.
VT UAS	***VT Unavailable Seconds*** — Counts the number of seconds in which the VT path is unavailable. The path is unavailable when 10 consecutive severely errored seconds are received, or when a condition leading to a failure (i.e., loss of signal) occurs. If the failure was preceded by one or more consecutive severely errored seconds, then VT path unavailability starts with the severely errored seconds. The VT path becomes available again after a minimum of 10 consecutive seconds without any severely errored seconds, or when the failure is removed, whichever is greater. All VT path related results count when the VT path is available. When the VT path is unavailable, only this result counts.
VT AIS SEC	***VT AIS/LOP Seconds*** — Counts the number of seconds in which one or more VT AIS or LOP occurs.
VT FEBE	***VT FEBE*** — Counts the number of VT BIP errors detected by the downstream PTE. It is calculated by summing the FEBE counter of the path status byte (V5, Bit 3) from each received VT superframe.
VT PTR JUST	***VT Pointer Justifications*** — Counts the number of times the VT path pointer byte (V1 and V2) changed since initial SONET frame synchronization.
VT PTR INC	***VT Pointer Increments*** — Counts the number of times the VT pointer bytes (V1 and V2) indicated an increment to the VT payload pointer since initial SONET frame synchronization.

Table 2-27. SONET Virtual Tributary Overhead Category Test Results (Continued)

Displayed Test Result	Description
VT PTR DEC	***VT Pointer Decrements*** — Counts the number of times the VT pointer bytes (V1 and V2) indicated a decrement to the VT payload pointer since initial SONET frame synchronization.
VT PTR NDF	***VT Pointer New Data Flags*** — Counts the number of times the VT pointer bytes (V1 and V2) indicated an active new data flag (arbitrary change in pointer) since initial SONET frame synchronization. An active NDF occurs during a change in payload content, or after an AIS or some other failure condition.
VT PTR DATA	***VT Pointer Data*** — Presents the current VT pointer value from 0 to 103. *UNAVAILABLE* appears under a number of error conditions, such as line AIS, etc. *OUT OF RANGE* appears if the pointer value is outside 0 to 103.

2.101 ATM CATEGORY TEST RESULTS

When the appropriate options are installed, the ATM test results (see Table 2-28) enable the T-BERD 310 to analyze the ATM cell overhead and payload usage for DS1, DS3, OC-3c, and OC-12c rates. Unless otherwise noted, the following ATM results pertain only to the rate selected in the ATM RX-RATE SELECT auxiliary function (DS1, DS3, OC-3c, or OC-12c). DS1, DS3, OC-3c, and OC-12c ATM results are displayed in both ATM and SUMMARY categories on the mainframe (not on the 310-1).

NOTE

For example, DS1 ATM results are N/A unless ATM RX-RATE SELECT auxiliary function is configured for DS1, and DS1 payload is to ATM(HEC) or ATM(PLCP). ATM results are UNAVAILABLE if they are applicable, but no ATM cells have been received in the signal. Continuing with the DS1 ATM example, all physical layer DS1 results are simultaneously measured while DS1 ATM analysis is active and available on the Lid with the exception of Logic category results, since logic errors are not available when no pattern synchronization is obtained.

Table 2-28. ATM Category Test Results

Displayed Test Result	Description
MASK CELLS	***Mask Cells*** — Counts all cells received that match specified test mask receive addresses selected in the ATM RX auxiliary functions.
MASK CELL BW	***Mask Cell Bandwidth*** — Measures bandwidth of the selected received profile. Select received profile using the ATM RX-PROFILE auxiliary function.
MASK CELL RT	***Mask Cell Rate*** — Measures the cell rate of the selected received profile in cells per second (C/s).
IDLE BW	***Idle Bandwidth*** — Measures bandwidth of all idle cells as a percentage of the received signal.
IDLE RT	***Idle Cell Rate*** — Measures idle cells in cells per second (C/s).
IN-USE BW	***In-Use Bandwidth*** — Measures the active cell bandwidth as a percentage of the received signal.
IN USE RT	***In-Use Rate*** — Measures the active cells in cells per second (C/s).
BKGRD BW	***Background Bandwidth*** — Measures the active cell traffic that does not match the selected test mask. The value is measured as a percentage of the received signal, and does not include idle cells. The test cell can be selected with the ATM RX-TEST MASK auxiliary function.
BKGRD RT	***Background Rate*** — Measures the active cell traffic that does not match the selected test mask. This value is measured in cells per second (C/s) and does not include idle cells. Select test mask through the ATM RX-TEST MASK auxiliary function.

Table 2-28. ATM Category Test Results (Continued)

Displayed Test Result	Description
MIN/MAX BW	***Minimum/Maximum Bandwidth*** — Measures highest and lowest values for the bandwidth using the selected received bandwidth period. The bandwidth period is selected through the ATM RX-BW PERIOD auxiliary function.
MIN/MAX RATE	***Minimum/Maximum Rate*** — Records the highest and lowest in-use rates during the programmed bandwidth period. Select programmed bandwidth period through the ATM RX-BW PERIOD auxiliary function.
BURST BW	***Burst Bandwidth*** — Measures the current bandwidth using the selected received bandwidth period. The bandwidth period is selected through the ATM RX-BW PERIOD auxiliary function.
BURST RATE	***Burst Rate*** — Measures the current mask cell burst (in C/s) rate using the selected received bandwidth period.
MIN DLAY VAR	***Minimum Cell Delay Variation*** — Measures, in scientific notation of seconds, the maximum (maximum negative) cell delay variation on the transmitted cell profile. This result is only available when Delay Variation Results are enabled (selected) in the ATM RX-TEST MASK auxiliary function.[1]
MAX DLAY VAR	***Maximum Cell Delay Variation*** — Measures, in scientific notation of seconds, the maximum positive cell delay variation on the transmitted cell profile. This result is only available when Delay Variation Results are enabled (selected) in the ATM RX-TEST MASK auxiliary function.[1]
AVG DLAY VAR	***Average Cell Delay Variation*** — Measures, in scientific notation of seconds, the average cell delay variation on the transmitted cell profile. This result is only available when Delay Variation Results are enabled (selected) in the ATM RX-TEST MASK auxiliary function.[1]
TOTL CONGEST	***Total Marked Congestion*** — Measures bandwidth of all cells marked congested as a percentage of total active cells, not including idle cells, since initial cell synchronization.
MASK CONGEST	***Received Mask Cells Marked Congested*** — Measures bandwidth of the cells matching the receive mask words are marked congested, as a percentage of total active cells not including idle cells, since initial cell synchronization.
CLP=1	***Cells with CLP Equals One*** — Counts all cells that match the selected RX mask with CLP equal to 1.
% CLP=1	***Percent of Cells with CLP Equals One*** — Measures percentage of all cells that match the selected RX mask with CLP equal to 1.
MISINSERTED	***Misinserted Cells (TTC)*** — Counts cells that do not have the TTC payload. The result is only available when a TTC profile is received.
% MISINSERTED	***Percent of Misinserted Cells (TTC)*** — Measures percentage of cells that do not have the TTC payload. The result is only available when a TTC profile is received.
OUT OF SEQ	***Out Of Sequence TTC Sequence Number (TTC)*** — Counts cells that have an out of sequence TTC sequence number in the payload of the cell. The result is only available when TTC test cells are received.
% OUT OF SEQ	***Percent of Out Of Sequence TTC Sequence Number (TTC)*** — Measures percentage of cells that have an out of sequence TTC sequence number in the payload of the cell. The result is only available when TTC test cells are received.
DROP'D CELLS	***Dropped Received Mask Cells (TTC)*** — Counts the dropped RX Mask Cells. The result is only available when TTC test cells are received.
% DROP'D	***Percent of Dropped Received Mask Cells (TTC)*** — Measures percentage of dropped RX Mask cells. The result is only available when TTC test cells are received.
HEC ERRORS	***Header Error Control Errors*** — Counts all cells with at least one HEC error.
HEC ERR RATE	***Header Error Control Error Rate*** — Counts the ratio of HEC errors over the total number of received cells.
CORRECT ERRS	***Correctable HEC Errors*** — Counts the cells with only one HEC error. If a cell with a single HEC error is followed by consecutive cells that have one or more HEC errors, then only the first HEC errored cell is counted as correctable.
CORRECT RATE	***Correctable HEC Error Rate*** — Counts the ratio of correctable errors over the total number of received cells.

Table 2-28. ATM Category Test Results (Continued)

Displayed Test Result	Description
NON-COR ERRS	***Non-Correctable HEC Errors*** — Counts cells with more than one HEC error. Also the count of consecutive cells that have HEC errors excluding the first cell, if and only if, it has a single HEC error.
NON-COR RATE	***Non-Correctable HEC Error Rate*** — Counts the ratio of non-correctable errors over the total number of received cells.
CORR TAG	***Correlation Tag (TTC)*** — Indicates the current received TTC cell correlation tag number. The result is only available when a TTC profile is received.
ATM STATUS	***ATM Status Results, Summary Category*** — Displays the following ATM signal status conditions as they occur: **CELL SYNC nn** — Cell Synchronization indicates the reception of six consecutive unerrored HECs. This is equivalent to a cell delineation (CD) indication. **OCD nn** — Out of Cell Delineation — Indicates the reception of at least seven consecutive errored HECs after cell synchronization. This is equivalent to an out of sync indication. **LCD nn** — Loss of Cell Delineation — Indicates continued loss of cell synchronization 4 ms after out of synchronization occurred. This is equivalent to a sync loss indication. **LCD FAIL nn** — Loss of Cell Delineation Failure — Indicates synchronization loss is present for 2.5 seconds. Cleared when cell synchronization is regained and loss of synchronization has not occurred in 10 seconds. This is equivalent to a synchronization failure indication. **NO MASKED nn** — No test masked cells received that match specified test mask receive addresses selected in the ATM RX auxiliary functions. **ALL IDLE nn** — All test cells received that are idle in the ATM RX auxiliary functions.
CSF SECONDS	***Cell Synchronization Failure Seconds*** — Counts number of cell synchronization failure seconds detected.
AIS SECONDS	***AIS Alarm Seconds*** — Counts the seconds an ATM AIS alarm is detected since the last test restart or history reset.
RDI SECONDS	***RDI Alarm Seconds*** — Counts the seconds an ATM RDI alarm is detected since the last test restart or history reset.
LOOP END-END	***Loopback End-to-End*** — Counts the number of ATM end-to-end loopback cells received since the last test restart.
LOOP SEGMENT	***Loopback Segment*** — Counts the number of ATM segment loopback cells received since the last test restart.
PLCP FRM ERR	***PLCP Frame Word Error Count*** — Displays the cumulative frame word errors detected according to the ATM UNI 3.0 specification.[2]
PLCP BIP ERR	***PLCP Bit Interleaved Parity Error Count*** — Displays the cumulative count of the [illegible] bit interleaved parity (BIP) errors detected according to the ATM UNI 3.0 specification. Each of the PLCP overhead BIP-8 bytes is tested separately.[2]
PLCP BIP RT	***PLCP Bit Interleaved Parity Error Rate*** — Displays the cumulative BIP error rate by using the BIP error counts.[2]
PLCP FEBE	***PLCP Far End Block Errors*** — Displays the number of PLCP BIP errors that occurred at the far end of a duplex ATM connection.[2]
ERR'D CELLS	***Errored Cell Count*** — Displays the number of TTC test cells matching the test mask and were errored.
ERR'D RATE	***Errored Cell Rate*** — Displays the rate at which TTC test cells were errored.[1]
AVG RT DELAY	***Average Round Trip Delay*** — Displays the average round trip delay of cells from the time a cell was transmitted to the time it is received back.[1]
MAX RT DELAY	***Maximum Round Trip Delay*** — Displays the maximum round trip delay of cells from the time a cell was transmitted to the time it is received back.[1]

1 Not applicable for OC-12c rate.
2. Not applicable for OC-3c or OC-12c.

DS1/DS0 ANALYZER OPTION TEST RESULTS

2.102 INTRODUCTION

The DS1/DS0 Analyzer Option has full Bit Error Rate Test (BERT) capabilities and supports all the DS1 results defined in the following sections. Two results can be displayed at one time in the RESULTS I and RESULTS II windows. The **RESULTS I** and **RESULTS II** switches enable the categorized results to be displayed.

The available results depend on framing type, pattern synchronization, installed options, etc. Results that are *not available* display the message *UNAVAILABLE* in place of the result count. The results that are *not applicable* to the current mode display *N/A* in place of the result count. When the displayed count exceeds 99,999,999, a ">" (greater than sign) appears in the window. When the number rolls over, the count continues.

2.103 SUMMARY CATEGORY

The SUMMARY category automatically displays key results that are non-zero or out-of-specification. This allows quick access to the results without having to search through the other categories. The results that appear in the SUMMARY category include:

- BIT ERRORS (LOGIC category)
- SLIPS (LOGIC category)
- VIOLATIONS (BPV category)
- FRM ERRORS (FRAME category)
- CRC ERRORS (FRAME category)
- RX FREQ (SIGNAL category)

When all SUMMARY results are error-free, the message *ALL RESULTS OK* is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press either the **RESULTS I Results** switch or **RESULTS II Results** switch to scroll through the results.

2.103.1 310-9B Option PRM Test Results

When the 310-9B option is installed and the PRM results are enabled, the following results can appear in the SUMMARY category. It should be noted that these results apply to the far-end received signal.

- FAR BPV SEC (BPV category)
- FAR FRM ES (FRAME category)
- FAR FRM SES (FRAME category)
- FAR SLIP SEC (FRAME category)
- FAR CRC ERR (FRAME category)

The optional ESF datalink far-end Performance Report Message (PRM) results enable the DS1/DS0 Analyzer Option to monitor and report on the status of the ESF PRM as described in the ANSI T1.403-1989 standard. The far-end PRM results are available when the ESF or optional ESFz operating mode is selected and the AUX-PRM receiver auxiliary function is enabled. The AUX-PRM auxiliary function determines whether the following PRM results are reported.

BPV Category
FAR BPV SEC — Far-End BPV Seconds

FRAME Category
FAR FRM ES — Far-End Frame Error Seconds
FAR FRM SES — Far-End Severely Errored Framing Seconds
FAR SLIP SEC — Far-End Controlled Slip Seconds
PAYLOAD SOURCE — Far-End Payload Source/Loopback
FAR CRC ERR — Far-End CRC Error Events
FCRC 1 — Far-End CRC 1 Bin
FCRC 2-5 — Far-End CRC 2 to 5 Bin
FCRC 6-10 — Far-End CRC 6 to 10 Bin
FCRC 11-100 — Far-End CRC 11 to 100 Bin
FCRC 101-319 — Far-End CRC 101 to 319 Bin
FCRC >319 — Far-End CRC 320 to 333 Bin

TIME Category
FAR PRM SEC — Far-End Performance Report Seconds

When a far-end PRM result count is an approximation because of a lost PRM, a "~" (tilde) precedes the result. The results are halted when the frame synchronization or the signal is lost during testing. When the FAR CRC ERR result is displayed and the indicated count is an approximation of the actual CRC error count, a ">" (greater than) sign precedes the count.

2.103.2 310-9B Option DS1 SCAN Mode Test Results

When the DS1/DS0 Analyzer Option is configured in SCAN mode, the results appear according to the selected SCAN mode: CONTINUE or TRIGGER.

SCAN CONTINUE — In the continuous DS1 scan mode, the RESULTS I window displays the CYCLE and CHANNEL results. The CYCLE result indicates the number of times the scan has cycled completely through all the DS1 channels. The CHANNEL number result indicates the channel which is currently being scanned. The RESULTS II window displays the status messages, alarms, or errors. If the dropped DS1 channels are error free, the message *ALL CHANNELS OK* appears.

SCAN	CYCLES:	78	#10 d4 qrss
CONTINUE	CHANNEL:	10	RESULTS OK

When an error or alarm is detected, the channel number and error appear in the RESULTS II window.

SCAN	CYCLES:	78	#10 d4 qrss
CONTINUE	CHANNEL:	10	FRM ERR H

An **H** or **C** appears next the to test result indicating the error status as *History* or *Current*. The following errors or alarms are detectable:

CRC ERRORS — Cyclic Redundancy Check Errors
FRM ERRORS — Frame Errors
SLIPS — Timing Slips (requires the 310-9B option and a reference signal source)
ALL ONES — All Ones Pattern
YELLOW — Yellow Alarm
FRM LOSS— Frame Synchronization Loss

SCAN TRIGGER — In SCAN TRIGGER mode the RESULTS I window displays the CYCLE and CHANNEL results. The CYCLE result indicates the number of times the scan has cycled completely through all the DS1 channels. The CHANNEL number result indicates the channel which is currently being scanned. The RESULTS II window displays test status messages.

SCAN	CYCLES:	78	SEARCHING FOR
TRIGGER	CHANNEL:	10	TRIGGER EVENT

If the scan detects a selected event from the AUX-SCAN TRIG auxiliary function, the DS1/DS0 Analyzer Option stops scanning and automatically configures to the dropped channel. A leading asterisk (*), framing format, and pattern appear in lowercase characters in the MODE/PATTERN window. When an event is detected, scanning stops and full DS1 logic, BPV, CRC, frame, and signal error analysis is performed. The LOGIC category is not applicable during live data analysis. The RESULTS I and II windows provide BERT analysis results.

*t1 slc	BIT ERRORS	FRM ERRORS
*qrss	786	2

2.104 LOGIC CATEGORY

Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization is obtained. The results are also not available when sending loop codes. During loss of frame or pattern synchronization, the accumulation of errors is halted.

2.104.1 DS1 Test Results

The DS1 LOGIC category test results are defined in Table 2-29.

Table 2-29. LOGIC Category DS1 Test Results

Displayed Test Result	Description
BIT ERRORS	***Bit Errors*** — The number of received pattern bits which have a value opposite that of the corresponding transmitted bit pattern since initial DS1 pattern synchronization.
BIT ERR RT	***Bit Error Rate*** — The ratio of pattern bit errors to received pattern bits since initially acquiring pattern synchronization.
ASYNC ERR SEC	***Asynchronous Errored Seconds*** — The number of seconds during which one or more pattern bit errors occurred since initial DS1 pattern synchronization.

Table 2-29. LOGIC Category DS1 Test Results (Continued)

Displayed Test Result	Description
SYNC ERR SEC	***Synchronous Errored Seconds*** — The number of seconds during which at least one pattern bit error has occurred. Each second is initiated by, and synchronized to, a pattern bit error.
%EFS	***Bit, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while DS1 pattern synchronization is present.
SYNC L SEC	***Out-of-Synchronization Seconds*** — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS1 pattern synchronization.
SEV ERR SEC	***Severely Errored Seconds*** — The number of seconds during which the pattern bit error rate exceeded or equaled 10^{-3} b/s.
CSES	***Consecutive Severely Errored Seconds*** — The number of groups of three or more severely errored seconds.
SLIPS	***Slips*** — The number of times the received pattern becomes skewed relative to the expected (i.e., internally generated) test pattern. When a slip is detected, the DS1/DS0 Analyzer Option automatically resynchronizes to the received pattern. However, pattern bit errors are not suppressed during this process. Pattern slips are available only when using pseudorandom patterns. (Timing slips are measured from the SIGNAL category.)

2.104.2 G.821 Results Option Test Results

The G.821 Results Option enables the DS1/DS0 Analyzer Option to evaluate the long-term performance of your system. The option adds eight performance analysis results to the LOGIC category. The G.821 performance results are defined in Table 2-30.

Table 2-30. LOGIC Category DS1 G.821 Results Option Test Results

Displayed Test Result	Description
AVAIL SEC	***Available Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is less than 10^{-3}
%AVAIL SEC	***% Available Seconds*** — The ratio, expressed as a percentage, of available seconds to the total elapsed seconds since pattern synchronization.
%SEV ER SEC	***% Severely Errored Seconds*** — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.
DEG MIN	***Degraded Minutes*** — A count of minutes during which the bit error ratio is worse than 10^{-6} and less than 10^{-3}
%DEG MIN	***% Degraded Minutes*** — The ratio, expressed as a percentage, of degraded minutes to the number of available minutes
UNAVAIL SEC	***Unavailable Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is greater than or equal to 10^{-3}

2.105 BPV CATEGORY

Bipolar violations are caused by successive DS1 pulses with the same polarity being detected (except those pulses that are part of the B8ZS encoding). Bipolar violation results are only accumulated when the signal is present. The BPV category results are defined in Table 2-31.

Table 2-31. BPV Category DS1 Test Results

Displayed Test Result	Description
VIOLATIONS	***Bipolar Violations*** — The number of bipolar violations (BPVs) detected since the beginning of the test. Intentional B8ZS code violations are excluded from the count.
BPV ERR RT	***BPV Error Rate*** — The ratio of BPVs to received bits since initially acquiring signal presence
BPV ERR SEC	***BPV Errored Seconds*** — The number of seconds during which one or more BPVs occurred since the beginning of the test
FAR BPV SEC	***Far-End BPV Seconds*** — The number of seconds during which one or more BPVs occurred in the far-end received signal. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status. Requires the 310-9B option.

2.106 FRAME CATEGORY

Frame errors begin accumulating after initial frame synchronization on the incoming DS1 signal. For T1 circuits with ESF or optional ESFz framing, the DS1/DS0 Analyzer Option detects and accumulates CRC-6 errors which are used to calculate the CRC error rate and CRC errored seconds. The DS1/DS0 Analyzer Option only compiles the results that apply to the selected framing format.

2.106.1 DS1 Test Results

The DS1 FRAME category test results are defined in Table 2-32.

Table 2-32. FRAME Category DS1 Frame Test Results

Displayed Test Result	Description
FRM ERRORS	***Frame Errors*** — The number of frame errors detected since initial DS1 frame synchronization.
FRM ERR RT	***Frame Error Rate*** — The ratio of frame errors to received framing bits since initially acquiring frame synchronization.
FRM ERR SEC	***Frame Errored Seconds*** — The number of seconds during which one or more frame errors occurred since initial DS1 frame synchronization.
FRM SES	***Frame Severely Errored Seconds*** — The number of seconds during which the total number of frame errors equals 12 or more (D4 framing only).
FRM L SEC	***Frame Loss Seconds*** — The number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS1 frame synchronization.
CRC ERRORS	***Cyclic Redundancy Check Errors*** — The number of CRC errors detected since initial DS1 frame synchronization. CRC errors are counted only when ESF or optional ESFz framing is present in the received T1 data.

Table 2-32. FRAME Category DS1 Frame Test Results

Displayed Test Result	Description
CRC ERR SEC	***Cyclic Redundancy Check Errored Seconds*** — The number of seconds during which one or more CRC errors occurred
CRC ERR RT	***Cyclic Redundancy Check Error Rate*** — The ratio of CRC errors to the number of superframes received
CRC SES	***Cyclic Redundancy Check Severely Errored Seconds*** — The number of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.

2.106.2 310-9B Option PRM Test Results

Table 2-33 defines the PRM test results that are available when the 310-9B option is installed.

Table 2-33. FRAME Category 310-9B Option PRM Test Results

Displayed Test Result	Description
FAR FRM ES	***Far-End Frame Error Seconds*** — The number of seconds during which one or more frame errors occurred in the far-end received signal. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.
FAR FRM SES	***Far-End Severely Errored Framing Seconds*** — The number of seconds during which two or more frame errors occurred in less than 3 ms in the far-end received signal. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.
FAR SLIP SEC	***Far-End Controlled Slip Seconds*** — The number of seconds during which controlled slips occurred in the far-end received signal. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status.
PAYLOAD SOURCE	***Far-End Payload Source/Loopback*** — Identifies the direction of the PRM according to the PRM Command/Response Bit (C/R) and the Payload Loopback Activated Bit (LB). In end-to-end applications, a customer-generated PRM is indicated as CUST (C/R = 0 and LB = 0), and the carrier-generated PRM is indicated as CARR (C/R = 1 and LB = 0) in the display. In payload loopback applications, the customer-generated PRM is indicated as CUST LOOP (C/R = 0 and LB = 1) when the customer is looped back, and the carrier-generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) when the carrier is looped back.
FAR CRC ERR	***Far-End CRC Error Events*** — The minimum number of CRC errors reported in the following FCRC results. A ">" (greater than sign) preceding the count indicates that the Bins 2 through 6 are non-zero. This result reports on the PRM CRC Error Event Bits (G1 to G6) status.
FCRC 1	***Far-End CRC 1 Bin*** — The number of seconds during which only one CRC error was reported in the far-end received signal. This result reports on the first PRM CRC Error Event Bit (G1 = 1) status.
FCRC 2-5	***Far-End CRC 2 to 5 Bin*** — The number of seconds during which 2 to 5 CRC errors were reported in the far-end received signal. This result reports on the second PRM CRC Error Event Bit (G2 = 1) status.
FCRC 6-10	***Far-End CRC 6 to 10 Bin*** — The number of seconds during which 6 to 10 CRC errors were reported in the far-end received signal. This result reports on the third PRM CRC Error Event Bit (G3 = 1) status.
FCRC 11-100	***Far-End CRC 11 to 100 Bin*** — The number of seconds during which 11 to 100 CRC errors were reported in the far-end received signal. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1) status.
FCRC 101-319	***Far-End CRC 101 to 319 Bin*** — The number of seconds during which 101 to 319 CRC errors were reported in the far-end received signal. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1) status.
FCRC >319	***Far-End CRC 320 to 333 Bin*** — The number of seconds during which 320 to 333 CRC errors were reported in the far-end received signal. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1) status.

2.107 SIGNAL CATEGORY

The SIGNAL category results include signal level, frequency, and loss seconds. The results are accumulated after initial signal detection.

2.107.1 DS1/DS0 Signal Test Results

The DS1/DS0 SIGNAL category test results are defined in Table 2-34.

Table 2-34. SIGNAL Category DS1/DS0 Signal Test Results

Displayed Test Result	Description
SIG L SEC	***Signal Loss Seconds*** — The number of seconds during which the received DS1 signal was lost for all or part of a second since initial signal detection.
RX FREQ	***Receive Frequency*** — The frequency of the clock recovered from the received data measured in Hz.
RX LVL dBdsx	***Receive Signal Level*** — The level of the received DS1 signal in dB relative to a standard 3-volt base-to-peak signal (DSX level).
abcd	***ABCD Channel Signaling Status*** — The result displays the channel signaling bits for all 24 DS0 channels in D4 or SLC-96 (A and B) and ESF or optional ESFz (A, B, C, and D) framing. Scrolling to this result causes the entire display (both lines) to show the signaling bit states for each DS0 channel. The signaling bits are displayed as shown. *N/A* appears in channels C and D when D4 or SLC-96 framing is selected.
RX LVL dBm	***Received Signal Level in dBm*** — The level of the average power in the currently selected DS0 channel, set DS0 DROP CHANNEL switch.
TIMING SLIPS	***DS1 Timing Slips*** — The number of bit slips (+/-) and frame slips (absolute value) counted when the DS1 test signal slips from the DS1 reference signal after both signals are present simultaneously.
SYNC MSG	***ESF Datalink Synchronization Message*** — Indicates the bit-oriented message (BOM) received over the ESF datalink. The test results displays the following BOMs: ***20 PPM CLK*** — A 20 part per million based clock is being used. ***RESERVED*** — The received message is reserved for other defined purposes. ***STRATUM 1*** — A Stratum 1 based clock is being used. ***STRATUM 2*** — A Stratum 2 based clock is being used. ***STRATUM 3*** — A Stratum 3 based clock is being used. ***STRATUM 4*** — A Stratum 4 based clock is being used. ***TRACE UNKN*** — Traceability is unknown. ***DO NOT USE*** — The timing source should not be used for synchronization, as it would cause a timing loop.

2.107.2 DS1 Timing Slip Measurements

The timing slip measurement identifies frequency deviations which cause uncontrolled and controlled clock slips. A received DS1 test signal is compared to a DS1 reference signal. This comparison allows the DS1/DS0 Analyzer Option to count the number of test signal bits that move past the reference signal bit as illustrated in Figure 2-37.

Figure 2-37. DS1 Timing Slips

The TIMING SLIPS result indicates frame slips and bit slips between the test signal and the reference signal (see Figure 2-38).

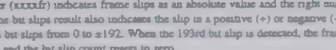


Figure 2-38. Timing Slips Results Display

The left number (xxxxfr) indicates frame slips as an absolute value and the right number (+xxxbt) indicates the bit slips. The bit slips result also indicates the slip as a positive (+) or negative (-) direction. The bit slip result indicates bit slips from 0 to ±192. When the 193rd bit slip is detected, the frame slip result is incremented by one and the bit slip count resets to zero.

The numeric value is a range from 0 to 999. This value represents the total number of frame slips that have occurred. One frame slip is equal to 193 bit-slips.

The DS1 test signal is selected with the **DS1 SOURCE** switch and is taken from one of the following sources:

- **EXT. INPUT** — DS1 RECEIVE connector (DS1/DS0 Analyzer Option)
- **DS3 DROP** — DS3 RECEIVE connector
- **SONET DROP** — STS-1 RECEIVE connector or OC-1/3 RECEIVE connector (SONET Option)

The DS1 reference signal is selected with the AUX SLIP REF auxiliary function and is taken from one of the following sources.

- DS1 RECEIVE connector (DS1/DS0 Analyzer Option)
- DS3 RECEIVE connector
- STS-1 RECEIVE connector (SONET Option)
- OC-1/3 RECEIVE connector (SONET Option)
- SECONDARY DS3 RECEIVE connector (DS1 Insert/Secondary DS3 Receive Option)
- OC-12/OC-12c RECEIVE connector (310-12 SONET Option)
- DS1 INSERT INPUT connector (DS1 Insert/Secondary DS3 Receive Option)
- OC-48 or OC-48c RECEIVE connector (310-21 SONET option)

When the same signal source is used, the TIMING SLIPS result indicates SAME REF (same reference). If either signal is lost after both signals are present simultaneously, the bit slip result resets to zero and the frame slip result is frozen. As long as either signal is missing, UNAVAILABLE remains in the result. If the DS1 reference signal is lost, REF LOSS appears, the bit slip result resets to zero, and the frame slip result is frozen. If the DS1 test signal is lost, CLK LOSS appears, the bit slip result resets to zero, and the frame slip result is frozen. If the DS1 reference signal and DS1 test signal are lost, only CLK LOSS appears.

2.108 TIME CATEGORY

The TIME category lists current date, time, and timed results. The TIME category results are defined in Table 2-35.

Table 2-35. TIME Category DS1 Test Results

Displayed Test Result	Description
TIME	***Current Time of Day*** — The current time of day in hours, minutes, and seconds. The time is set through the TIME-SET TIME auxiliary function.
DATE	***Current Date*** — The current day and month. The date is set through the TIME-SET DATE auxiliary function.
ELAPSED TIME	***Elapsed Time*** — The elapsed time in hours, minutes, and seconds since the last DS1/DS0 Analyzer Option test restart.
TEST LENGTH	***Timed Test Length*** — The currently set test length for a timed test in hours and minutes on the DS1/DS0 Analyzer Option. The test length is set through the TIME-TEST LENGTH auxiliary function.
TIME LEFT	***Timed Test Time Left*** — The time remaining for a timed test in hours, minutes, and seconds on the DS1/DS0 Analyzer Option.
FAR PRM SEC	***Far-End Performance Report Seconds*** — The number of total seconds, since test restart, during which a valid PRM was received. Requires the 310-9B option.

SECTION 3
PRINTER OPERATION

3.1 INTRODUCTION

The T-BERD 310 can generate four types of printouts: test results, controls, pulse shape, and messages. This section describes each of the printouts and how to generate them using either the RS-232-C or IEEE-488 interface.

3.2 T-BERD 310 PRINTER SETUP

The following connections, controls, indicators, and auxiliary functions are used to set up the printer and T-BERD 310.

3.2.1 Printer Connections

The RS-232 interface is located on the side panel. The connector is configured as a Data Communications Equipment (DCE) connection, which allows you to connect the T-BERD 310 to Data Terminal Equipment (DTE). Connecting to another DCE, such as a modem, is possible using a DCE/DCE adaptor (crossover) cable. Refer to Table 4-1 for the RS-232 pin assignments.

3.2.2 PRINT Auxiliary Group

The PRINT auxiliary group controls the operation and printout generation when using either the RS-232-C or IEEE-488 interface.

Table 3-1 shows the auxiliary functions used to configure the interface parameters. The default RS-232 interface settings match the TTC PR-40A printer default parameters. Refer to Section 2.65 for additional information on the PRINT auxiliary group.

Table 3-1. Printer Control Auxiliary Functions

Auxiliary Function	Definition	Selections
INTERVAL	Timed Printout Interval	0 to 24 Hours/00 to 59 minutes
MODE	Print Mode	CONTINUOUS or DELTA
FORMAT	Printout Format	NORMAL, CUSTOM, or SUMMARY
CUSTOM	Customized Printout Contents	Category, Test Result, or LED/ON or OFF
GRAPH	Print Pulse Shape Graph	Print PULSE
BAUD RATE	RS-232 Interface Baud Rate	110, 300, 600, 1200, 2400, 4800, or 9600
PARITY[1]	RS-232 Interface Parity	EVEN, ODD, or NONE
TERMINATOR	Line Terminator	CR, LF, or CRLF
WIDTH	Printout Line Width	40 or 80

Table 3-1. Printer Control Auxiliary Functions (Continued)

Auxiliary Function	Definition	Selections
PORT (optional)	Printer/Remote Control Interface Selection	RS-232, IEEE 488/bus 0 to 30, or 488 T/O
PRINT TYPE	Set Printout Type	RESULTS or CONTROLS
PRINT EVENT	Set Printout Event	OFF, 15 MIN, 30 MIN, TEST END, ERR SEC, or TIMED

1. Word length is controlled by the parity selection, seven bits for odd or even parity and eight bits for no parity.

3.3 DS1/DS0 ANALYZER OPTION PRINTER SETUP

The following connections, controls, indicators, and auxiliary functions are used to set up the printer and DS1/DS0 Analyzer Option.

3.3.1 Printer Connections

Printouts from the DS1/DS0 Analyzer Option are generated through the T-BERD 310 RS-232 interface located on the side panel. The DS1/DS0 Analyzer Option must be connected to the T-BERD 310 through the DS1/DS0 Analyzer Option port connector to generate printouts. Refer to the previous section for additional information on the RS-232 interface.

3.3.2 Printer Controls

The DS1/DS0 Analyzer Option printout generation is controlled through the DS1/DS0 Analyzer Option **PRINT** switch and the T-BERD 310 PRINT-PRINT EVENT auxiliary function.

3.3.2.1 DS1/DS0 Analyzer Option PRINT Switch

The **PRINT** switch generates either a test results or a controls printout. The switch performs the following functions:

RESULTS — This position generates a date- and time-stamped printout of the current DS1/DS0 Analyzer Option test results. Test results become available only after the DS1/DS0 Analyzer Option has received a valid signal. The test results can be customized through the AUX-CUSTOM auxiliary function.

CONTROLS — This position generates a date- and time-stamped printout of the current DS1/DS0 Analyzer Option front-panel and auxiliary function configurations. This printout records how the DS1/DS0 Analyzer Option is configured for testing.

3.3.2.2 T-BERD 310 PRINT-PRINT EVENT Auxiliary Function

The T-BERD 310 auxiliary function selects the event that automatically initiates a test results printout. Setting it to any print event selection generates both T-BERD 310 and DS1/DS0 Analyzer Option test results. However, the printouts from each unit are generated independently from each other. Refer to the previous section for more information.

3.3.3 Auxiliary Functions

The AUX-CUSTOM auxiliary function determines which DS1 test results and Status and Alarm LED conditions are printed in a customized test results printout. The custom test results printout is selected through the T-BERD 310 PRINT-FORMAT auxiliary function.

The T-BERD 310 PRINT auxiliary group controls the operation and printout generation of the DS1/DS0 Analyzer Option. The following auxiliary functions control the DS1/DS0 Analyzer Option test results printouts in addition to the T-BERD 310 printer configuration.

INTERVAL	Timed Test Length Interval
MODE	Printout Mode
FORMAT	Printout Format
TERMINATOR	Printout Line Terminator
WIDTH	Printout Line Width

Refer to the previous section for additional information on the T-BERD 310 auxiliary functions.

3.4 PRINTOUTS

The T-BERD 310 generates four types of printouts: controls, test results, status messages, and pulse shape. If a printer is not connected to the instrument, the printouts can be generated and stored in a 20-kilobyte print buffer.

Depending on the type of printout generated, up to approximately 20 test results printouts, 80 controls printouts, 400 status and alarm messages, or 9 pulse shapes can be stored in the print buffer. If the print buffer is full and a printer is not connected or is off line, the first and the most recent printouts are retained while any newly generated printouts overwrite ones stored in the middle of the print buffer queue. The print buffer can be purged by clearing the PRINT-PRINT EVENT auxiliary function.

In the event of a power loss, a power-down test results printout is also stored. When power is restored, the printout is generated along with any other stored printouts.

Unless otherwise indicated, the following information also applies to printouts generated by the DS1/DS0 Analyzer Option.

3.4.1 Test Results Printouts

A test results printout is a hard-copy list of the test results accumulated during a test. Figure 3-1 illustrates a sample test results printout. The following information describes the test results printout in Figure 3-1.

3.4.1.1 Printout Formats

The format is identified across the top of the test results printout. The format is selected through the PRINT-FORMAT auxiliary function. Depending on the configuration of the T-BERD 310, additional information, Status and Alarm LEDs, and test results may be reported.

NORMAL RESULTS PRINT — Lists all Status and Alarm (current and history) LEDs and test results for primary and secondary inputs.

Manual — Indicates the PRINT-PRINT EVENT auxiliary function was executed to initiate the test results printout.

Power Down — Initiated by a power loss. The printout is generated immediately after power up.

Squelch Off — Indicates the printout was generated after the printer squelch feature has been turned on and then turned off.

Test End — Indicates the PRINT-PRINT EVENT auxiliary function was set to TEST END and the printout was initiated at the end of a timed test.

Timed Results — Indicates the PRINT-PRINT EVENT auxiliary function was set to TIMED and the printout was generated at a specified interval. The test interval is set in the PRINT-INTERVAL auxiliary function.

3.4.1.3 Print Mode

The third line of the test results printout identifies the print mode (Continuous or Delta) that was used to accumulate the test results during the test. The print mode is selected with the PRINT-MODE auxiliary function. When the continuous print mode is used, the printed test results are continuously accumulated from test restart. When the delta print mode is used, the printed test results are accumulated from a test restart or the previous delta printout. Each time a printout is generated, the test results stored in the print buffer are reset to zero. Manual and power-down printouts are always printed in continuous mode regardless of the PRINT-MODE auxiliary function setting. The print mode only affects the printed test results, not the displayed test results.

3.4.1.4 Date and Time

The date and time on the printout indicate when the printout was requested; not when it was printed. The printouts are printed in sequential order by date and time. The date and time are set through the TIME-SET DATE and TIME-SET TIME auxiliary functions.

3.4.1.5 Status and Alarm LEDs

The printout shows which DS3 (Primary and Secondary) and DS1 Status and Alarm LEDs are ON or OFF at the time the printout was generated.

3.4.1.6 Printed Test Results

The test results are listed by category. The available test results depend on the configuration of the T-BERD 310 (and DS1/DS0 Analyzer Option). Test results that are *not available* display the message *UNAVAILABLE* in place of the result count. The test results that are *not applicable* to the current mode display *N/A* in place of the result count. When the count exceeds 99,999,999, a ">" (greater than sign) precedes the result, the number rolls over, and the count continues.

3.4.1.7 End of Printout

A normal test results printout ends with the message *END OF PRINTOUT*. However, if the printout is terminated before it is finished, the message *PRINTOUT TERMINATED BY USER* is issued.

CUSTOM RESULTS PRINT — Lists the user-selected Status and Alarm LEDs, FEAC codes, and test results for primary and secondary inputs. The individual test results and LEDs are selected through the T-BERD 310 PRINT-CUSTOM auxiliary function and the DS1/DS0 Analyzer Option AUX-CUSTOM auxiliary function.

SUMMARY RESULTS PRINT — Lists the Status and Alarm LEDs, the SUMMARY category test results or messages, and the DS3 far-end alarm (FEAC) messages for primary and secondary inputs.

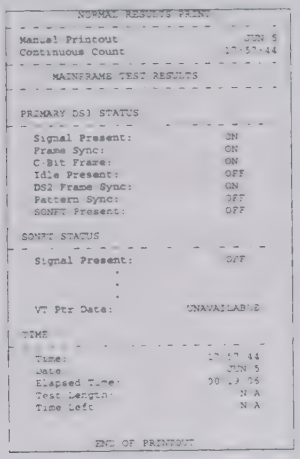


Figure 3-1. NORMAL RESULTS PRINT Printout

3.4.1.2 Print Type

The print type identifies how the printout was generated. The print types include:

15-Minute Timed Results — Indicates the PRINT-PRINT EVENT auxiliary function set to 15 MIN.

30-Minute Timed Results — Indicates the PRINT-PRINT EVENT auxiliary function was set to 30 MIN.

Errored Second Results — Indicates the PRINT-PRINT EVENT auxiliary function was set to ERR SEC.

3.4.2 Controls Printout

The controls printout lists the current setting of the T-BERD 310 (and DS1/DS0 Analyzer Option) front-panel switches and the auxiliary functions. The MAINFRAME CONTROLS PRINT is initiated by setting the PRINT-PRINT TYPE auxiliary function to CONTROLS. Figure 3-2 is an example of a MAINFRAME CONTROLS PRINT printout.

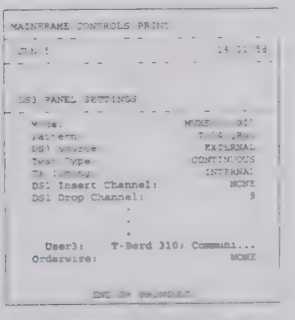


Figure 3-2. MAINFRAME CONTROLS PRINT Printout

3.4.3 Printed Messages

Status, alarm, and note messages are initiated automatically when an important development or condition occurs. The 2-line message format includes the type of message (status, alarm, or note), the message identifying the reported condition, time, date, and the number of times the condition has occurred. Figure 3-3 illustrates a typical sequence of status messages at a test restart. The messages are described in Appendix B.

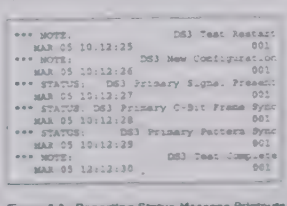

*** NOTE: DS3 Test Restart
MAR 05 10:12:25 001
*** NOTE: DS3 New Configurat.on
MAR 05 10:12:26 001
*** STATUS: DS3 Primary Signa. Present
MAR 05 10:12:27 001
*** STATUS: DS3 Primary C-Bit Frame Sync
MAR 05 10:12:28 001
*** STATUS: DS3 Primary Pattern Sync
MAR 05 10:12:29 001
*** NOTE: DS3 Test Complete
MAR 05 12:12:30 001

Figure 3-3. Reporting Status Message Printouts

3.4.3.1 *Status Messages*

Status messages indicate positive conditions in the received signal and relate to the state of the Status LEDs. Status messages start with the header "*** STATUS:".

3.4.3.2 *Alarm Messages*

Alarm messages indicate negative conditions in the received signal and relate to the state of the Alarm LEDs. Alarm messages start with the header "*** ALARM:".

3.4.3.3 *Note Messages*

Note messages indicate conditions affecting the operation of the T-BERD 310. Note messages start with the header "*** NOTE:".

3.4.4 Pulse Shape Graph

The T-BERD 310 pulse shape graph provides a graphic printout of the normalized DS3 pulse shape. The pulse shape graph includes the pulse shape, date, time, power in dBm, level in volts, pulse shape pass/fail indication, pulse width, rise time, fall time, and the selected pulse mask. Figure 3-4 illustrates a typical pulse shape graph.

A graphics compatible printer with parity set to none, e.g., the TTC PR-40A Thermal Printer, and connected to the RS-232 interface is required to print the pulse shape printout. The pulse mask is selected through the MISC-PULSE MASK auxiliary function. The pulse shape graph is generated through the PRINT-GRAPH auxiliary function. If the received signal is not present and the PRINT-GRAPH auxiliary function is executed, the message *Pulse Shape Unavailable* is printed in place of the graph.

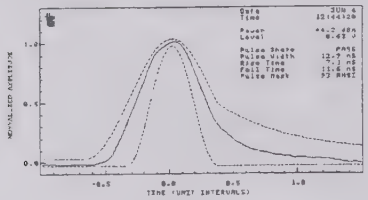


Figure 3-4. DS3 Pulse Shape Graph Printout

FRAMING — Indicates the framing format of the indicated channel which include: SLC, UNF (unframed), ESF, D4, and E1. A question mark (?) indicates an unknown problem with the dropped channel. A dash (-) indicates a gap channel in an E1 filled DS2 group.

FRM LOSS — Indicates a frame loss occurred.

FRM ERR — Indicates a frame error occurred.

CRC ERR — Indicates a CRC error occurred.

ALL ONES — Indicates an All Ones signal occurred.

```
                SCAN RESULTS PRINT

Manual Printout                              JUN 5
                                          17:47:25

                DS1 SCAN RESULTS

Cycles:                                          2
Channel:                                         7

     |      | F | F | C | A |   | T | S |
     | C | F | R | R | R | L |   | M | R |
     | H | R | M | M | C | L | Y |   | C |
     | A | A |   |   |   |   | E | S |   |
     | N | M | L |   |   | O | L | L | L |
     | N | I | O | E | E | N | L | I | O |
     | E | N | S | R | R | E | O | P | S |
     | L | G | S | R | R | S | W | S | S |
   1 |D4 |   |   |   |   |   |   |   |   |
   2 |D4 |   |   |   |   |   |   |   |   |
   3 |D4 |   |   |   |   |   |   |   |   |
   4 |D4 |H  |H  |   |   |   |   |   |   |
   5 |D4 |   |   |   |   |   |   |   |   |
                    .
                    .
                    .
  23 |D4 |   |   |   |   |   |   |   |   |
  24 |D4 |H  |HC |   |H  |   |   |H  |   |
  25 |D4 |   |   |   |   |   |   |   |   |
  26 |D4 |   |   |   |   |   |   |   |   |
  27 |D4 |   |   |   |   |   |   |   |   |
  28 |D4 |   |   |   |   |   |   |   |   |

                END OF PRINTOUT
```

Figure 3-5. DS1 SCAN RESULTS Printout

YELLOW — Indicates a Yellow Alarm occurred.

SLIPS — Indicates a timing slip occurred (requires the 310-9A/B option and test reference source). An "R" appears on the indicated channel when the test reference source is not available.

SRC LOSS — Indicates the status of the signal source from which the DS1 channels are being dropped.

3.4.5 Printer Squelch Feature

The automatic printer squelch feature prevents a maximum number of errored second test results printouts or status and alarm messages from being generated in a 60-second period. Depending upon the test instrument configuration, between 5 and 20 printouts could activate the squelch. After the squelch is activated, the following message is printed.

```
*** NOTE:                        Squelch On
    MAR 05  12:12:30                    001
```

While the squelch feature is on, the T-BERD 310 continues to monitor for errored events, but no automatic errored second test results printouts or status and alarm messages are generated or stored. The timed and manual printouts are not affected by the squelch feature.

The squelch is turned off when five or less errored second test results printouts or status and alarm messages occur in a 60-second period. When this condition is met, the following message is printed indicating that the squelch is off.

```
*** NOTE:                        Squelch Off
    MAR 05  12:12:30                    001
```

A SQUELCH OFF test results printout immediately follows the *Squelch Off* message. Both printouts occur only when the squelch is turned off automatically. A status and alarm message count is also printed. The test results and message counts continue to accumulate when the squelch feature is on.

NOTE

The squelch feature is reset by pressing the **RESTART** switch, changing the PRINT-PRINT EVENT auxiliary function to OFF, changing the test length, or completing a timed test.

3.4.6 DS1 SCAN Test Results Printout

The DS1/DS0 Analyzer Option DS1 SCAN test results printout (see Figure 3-5) presents the accumulated test results during a continuous DS1 scan mode test. The DS1 SCAN test results printout is only available when SCAN mode is set to CONTINUE.

NOTE

When SCAN mode is set to TRIGGER a test results printout is not available. Once the selected trigger criteria is met, the message **** NOTE: 08:34:35 Trigger Event Found* is generated. This signifies that a standard test results printout (not a scan printout) can be generated.

Initiate the DS1 SCAN test results printout manually by pressing the DS1/DS0 Analyzer Option **PRINT RESULTS** switch or automatically by setting the PRINT-PRINT EVENT auxiliary function to 30 MIN or 15 MIN. If the auxiliary function is set to TEST END or ERR SEC, a DS1 SCAN test results printout is generated when the channel state changes. In order for a channel state change to be detected, two previous scan cycles must occur. The DS1 SCAN RESULTS printout presents the following information:

Cycles — Indicates the number of completed scan cycles.

Channels — Indicates the current channel being scanned at the time of the printout.

The error and alarm condition are indicated as follows:

C — The error or alarm is occurring at the moment of the printout.

H — The error or alarm occurred at some point in the past of the printout.

Blank — The condition has not occurred since the last test restart or initial signal presence.

3.4.7 DWDM Test Results Printout

The T-BERD 310 PRINT WDM TABLE AUX function prints the DWDM scan results in tabular form. All data is formatted according to the WDM RX UNITS AUX function. The channel list is sorted in ascending order for wavelength mode, and in descending order for frequency mode.

```
WDM RESULTS PRINT

DATE: 6/30/99                    TIME: 8:00:00 AM

TOTAL CHANNEL COUNT.                            40
TOTAL POWER:                              17.0 dBm

   WAVELENGTH     POWER       SNR
   1552.13 nm  -14.3 dBm   30.1 dB
   1552.14 nm  -17.6 dBm   28.6 dB
   1554.00 nm  -18.9 dBm   26.2 dB
   1554.52 nm  -13.0 dBm   34.5 dB
                    .
                    .
   1561.92 nm   15.8 dBm   29.7 dB
```

Figure 3-6. DWDM Wavelength Tabular Printout

```
WDM RESULTS PRINT

DATE: 6/30/99                    TIME: 8:00:00 AM

TOTAL CHANNEL COUNT.                             4
TOTAL POWER:                                  2 dBm

   FREQUENCY      POWER       SNR
   196.1000THz  -14.3 dBm   30.1 dB
   195.9347THz  -17.6 dBm   28.6 dB
   193.1127THz  -18.9 dBm   26.2 dB
   192.0937THz  -13.0 dBm   34.5 dB
                    .
                    .
   1561.92 nm   15.8 dBm   29.7 dB
```

Figure 3-7. DWDM Frequency Tabular Printout

3.5 COMPATIBLE PRINTERS

The T-BERD 310 generates printouts to either an RS-232-compatible serial or an IEEE-488-compatible listen-only, graphics dot-matrix printer. A graphics printer (TTC PR-40A or equivalent) is required to print the pulse shape printout. Table 3-2 lists the printer configurations available with the T-BERD 310.

Table 3-2. T-BERD 310 Printer Capabilities

Function	Selections
Printer Interfaces	RS-232-C — female 25-pin D connector. IEEE-488 — parallel connector.
Data Rates	RS-232-C — 110, 300, 600, 1200, 2400, 4800, or 9600 b/s. IEEE-488 — 300 words per second.
Character Length	RS-232-C — 7 bits with parity or 8 bits without parity. IEEE-488 — 8 bits.
Line Terminator	RS-232-C — CR, LF, or CRLF. IEEE-488 — CR, LF, or CRLF with EOI.
Flow Control	RS-232-C — DTR/CTS and in-band XON/XOFF supported.
Parity	RS-232-C — odd, even, or none.
Interface Configuration	RS-232-C — DCE. IEEE-488 — talk only or addressable.
Start Bits	RS-232-C — 1 bit.
Stop Bits	RS-232-C — 2 bits on transmit, 1 or more on receive.
Column Width	40 or 80.
Timing	RS-232-C — Asynchronous.
Character Format	ASCII.

3.6 PRINTING WITH TTC PR-40A THERMAL PRINTER

Use the following information to configure the T-BERD 310 to print with the TTC PR-40A Thermal Printer. The RS-232 interface default settings match the TTC PR-40A printer default parameters. The easiest way to configure the T-BERD 310 for the PR-40A printer is to press the **RESTART** switch during power-up. This reconfigures the T-BERD 310 with the factory defaults. The PR-40A factory defaults are listed in Table 3-3. The factory defaults for the PRINT auxiliary group are listed in Table 3-4.

NOTE

Pressing the **RESTART** switch during power-up clears ALL previous T-BERD 310 configurations and reconfigures the T-BERD 310 with the factory defaults.

Table 3-3. PR-40A Thermal Printer Default Settings

Switch	Position	Function	Parameter
Printer Control DIP Switches			
SW1	OFF	Data Input	Serial
SW2	ON	Auto Line Feed	Enable
SW3	ON	Columns Per Line	40
SW4	OFF	Character Selection	Special

Table 3-3. PR-40A Thermal Printer Default Settings (Continued)

Switch	Position	Function	Parameter
SW5	OFF	Zero Format	Ø
SW6	OFF	International Characters	USA
SW7	ON	International Characters	USA
SW8	ON	International Characters	USA
RS-232 DIP Switches			
SW1	ON	Data Bits	8 (GRAPHICS)
SW2	ON	Parity	DISABLED
SW3	OFF	Parity Selection	EVEN
SW4	OFF	Baud Rate	2400
SW5	ON	Baud Rate	2400
SW6	OFF	Baud Rate	2400

Table 3-4. T-BERD 310 PRINT Auxiliary Group

Auxiliary Function	Factory Default	Description
Printer Control		
INTERVAL	0600	Timed Test Length Interval
MODE	Continuous	Printout Mode
FORMAT	Normal	Printout Format
CUSTOM	All Off	Customized Printout Contents
GRAPH	N/A	Print Pulse Shape Graph
WIDTH	40	Printout Line Width
RS-232 Interface Control		
BAUD RATE	2400	RS-232 Interface Baud Rate
PARITY	None	RS-232 Interface Parity
TERMINATOR	CR	Printout Line Terminator
PORT	RS-232	Printer/Remote Control Interface Selection

3.7 PRINTING WITH IEEE-488 COMPATIBLE PRINTER

Use Table 3-5 to configure the T-BERD 310 to generate test results and controls printouts with an IEEE-488 compatible printer. The PRINT-TERMINATOR auxiliary function must be set for the proper line terminator. The PRINT-PORT auxiliary function must be set to 488 T/O to select the IEEE-488 interface in talk-only mode.

Table 3-5. IEEE-488 Printer Requirements

Function	Parameter
Printer Interface	Parallel connector
Data Rate	300 words per second
Character Length	8 bits

Table 3-5. IEEE-488 Printer Requirements (Continued)

Function	Parameter
Line Terminator	CR, LF, or CRLF with EOI.
Interface Configuration	Talk only or addressable.

SECTION 4
SPECIFICATIONS

4.1 INTRODUCTION

This section contains the specifications for the T-BERD 310 Communications Analyzer and its options.

4.2 GENERAL

4.2.1 Physical

Dimensions:	T-BERD 310 with Lid — 6.5"H x 14.0"W x 18.7"D (16.5 cm x 35.6 cm x 47.5 cm).
Weight:	T-BERD 310 with Lid — 24.2 lbs. (11 kg).

4.2.2 Environmental

Operating Temperature Range:	32°F to 113°F (0°C to 45°C).
Storage Temperature Range:	-40°F to 158°F (-40°C to 70°C).
Operating Humidity:	90% maximum, noncondensing.
Storage Humidity:	5% to 95% noncondensing.
Shock and Vibration:	Meets IEEE-743.

4.2.3 Power

Power:	115/220 VAC (automatic voltage selection), 90 to 264 VAC from 47 to 63 Hz.
Fuse:	5 A, 250 V, Slo-Blo, 5 x 20 mm (Littlefuse #218005 or equivalent).

4.3 INPUT

4.3.1 DS3 Input

Input Level Range:	HIGH — Accepts a nominal signal level of 1.2 Vp (0 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.9 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -26 dB of loss from the nominal signal level (0.9 Vp).

Output Impedance:	75 ohms nominal, unbalanced to ground.

4.4.2 DS1 Drop Output

Output Connector:	Bantam (new units) or WECO 310 (old units) jack, side panel.
Pulse Shape:	With output terminated in 100-ohm resistive load, the T-BERD 310 meets pulse shape specifications given in ITU-T Recommendation G.703; Bell Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411.
Jitter Attenuation:	Meets or exceeds the jitter attenuation characteristics of AT&T PUB43802 and Bellcore TR-TSY-000191.
Line Code:	AMI or B8ZS (selectable).

4.5 INPUT SIGNAL MEASUREMENTS

4.5.1 Power

An unframed All Ones pattern must be used to obtain an accurate power reading. The value is expressed in dBm and referenced across 75 ohms. 0 dBm corresponds to a DS3 signal level of approximately 0.39 Vp.

Power Levels:	10.0 to 13.4 dBm with an accuracy of ±2 dBm. -12.0 to 9.9 dBm with an accuracy of ±2 dBm. -26.0 to -12.1 dBm with an accuracy of ±2 dBm.
Resolution:	0.1 dBm.
Range:	Less than -26.0 to +13.4 dBm.

4.5.2 Frequency

Accuracy:	±6 ppm.
Resolution:	10 Hz.
Range:	44.736 MHz ±1.5 MHz.

4.5.3 Level

The maximum peak voltage of the received signal is measured.

Level Accuracy:	1.2 to 1.8 Vp with an accuracy of ±0.2 V. 0.80 to 1.1 Vp with an accuracy of ±0.1 V. 0.25 to 0.79 Vp with an accuracy of ±0.05 V. 0.00 to 0.24 Vp with an accuracy of ±0.02 V.
Level Resolution:	0.00 to 1.99 Vp with a resolution of 0.01 V.
Range:	0.00 to 1.99 Vp.

DSX — Accepts a nominal signal level of 0.6 Vp (450 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.5 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -26 dB of loss from the nominal signal level (0.5 Vp).

LOW — Accepts a nominal signal level of 0.3 Vp (900 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.2 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -20 dB of loss from the nominal signal level (0.2 Vp).

Input Jitter Tolerance:	The instrument meets or exceeds the mask specified in AT&T PUB 43802 and Bellcore TR-TSY-000009. For the 2^15-1 pattern, the mask is defined with a jitter amplitude of 5.0 UIp-p from 10 Hz to 2300 Hz, slope of -24 dB/decade from 2.3 kHz to 60 kHz, and an amplitude of 0.1 UIp-p from 60 kHz to 300 kHz.
Input Impedance:	75 ohms ±5%, unbalanced to ground.
Connector:	WECO 560A jack (BNC optional).
Frequency:	44.736 Mb/s ±1000 Hz.
Line Code:	B3ZS.

4.3.2 External Clock Input

Input Connector:	Non-isolated, AC-coupled, 75-ohm BNC.
Input Frequency Range:	44.736 MHz ±300 ppm.
Input Amplitude:	1 Vp-p to 3 Vp-p.

4.4 OUTPUT

4.4.1 DS3 Output

Output Connector:	Six WECO 560A jacks (one front panel and five side panel). Factory installed BNC jacks are also available.
Output Signal:	Internal Frequency — 44.736 MHz ±15 ppm.
Output Level Range:	HIGH — Nominal 1.2 Vp. Signal meets ANSI T1.102-1989, Table 5, and ITU-T Recommendation G.703 when transmitted through 450 feet of coaxial cable (WECO 728A, RG59B/U, or equivalent). DSX — Nominal 0.6 Vp. Signal meets ANSI T1.102-1989, Table 5, and ITU-T Recommendation G.703, Section 5. LOW — Nominal 0.3 Vp. Signal is equivalent to a DSX signal transmitted through 450 feet of coaxial cable (WECO 728A, RG59B/U, or equivalent).
Line Code:	B3ZS.

4.5.4 Receive Level in dBdsx

Level Accuracy:	8 to 11.5 dBdsx ±2 dBdsx. -13.9 to 7.9 dBdsx ±1 dBdsx. -27.9 to -14.0 dBdsx ±2 dBdsx.
Level Resolution:	0.1 dBdsx.
Range:	-27.9 to +11.5 dBdsx.

4.6 ALARM CRITERIA

Signal Loss:	0.02 ms without valid input pulses.
Frame Loss:	3 OUT OF 15 — 3 out of 15 F-bits in error, or 2 out of 3, 010 M-bit sequences in error. 6 OUT OF 15 — 6 out of 15 F-bits in error.
DS2 Frame Loss:	2 out of 4 DS2 F-bit errors. Occurs when the DS2 corresponding to the selected DS1 drop channel loses frame synchronization.
Pattern Loss:	FAST — 1024 errors per 32,767 data bits. SLOW — 250,000 errors per 1,000,000 bits.
Blue (AIS):	STUCK C-BIT — valid framing, valid parity, all stuffing indicator C-bits equal zero, and the 1010 criteria. 1010 — 30 ms of 1010 pattern with framing.
Yellow:	Both X-bits = 0.
Far-End Alarm:	Receipt of valid far-end alarm message (not loop codes) through the third C-bit in subframe 1 (FEAC-bit).

4.7 PULSE SHAPE CRITERIA

ANSI:	T1.102-1991, Figure 5.
ITU-T:	Proposed ITU-T G.703, Figure 14/G.703.
93 ANSI.	T1.102-1993 and ANSI T1.404-1993 Network Interface pulse mask

4.8 TEST PATTERNS

4.8.1 Non-Channelized Test Pattern Definitions

2^31-1.	Pseudorandom pattern with length of 2^{31}-1 bits. This pattern conforms with ITU-T Recommendation O.151.
2^23-1	Pseudorandom pattern with length of 2^{23}-1 bits. This pattern conforms with ITU-T Recommendation O.151.
2^20-1	Pseudorandom pattern with length of 2^{20}-1 bits. This pattern conforms with Bell Compatibility Bulletin No. 114.

2^15-1	Pseudorandom pattern with length of 2^{15}-1 bits. This pattern conforms with ITU-T Recommendation O.151.
1111:	Fixed pattern consisting of marks only.
1100:	Fixed pattern of two marks followed by two spaces. In framed mode, the pattern is synchronized to the framing bits. In addition, C-bits are changed to indicate M13 or C-bit parity Idle Signal as described in the ANSI T1.107-1990 standard.
1010:	Fixed pattern of one mark and one space. In framed mode, the pattern is synchronized to the framing bits. When either M13 or C-bit parity framing is on, this is equivalent to sending a Blue Signal. All C-bits are set to zero to indicate stuck C-bits and the FID-bit is set to zero as described in the ANSI T1.107-1990 standard.
USER1:	3- to 24-bit programmable pattern.

4.8.2 Channelized Test Pattern Definitions

T1D4 1:7	F01000000.... Pattern is aligned with the T1 D4 framing (F) format as indicated.
T1D4 QRSS	2^{20}-1 bit pseudorandom pattern with 14-zero suppression and T1 D4 framing.
T1D4 3/24	F0100 0100 0000 0000 0000 0100.... Pattern is aligned with the T1 D4 framing (F) format as indicated.
T1D4 1004Hz:	1004 Hz tone on all DS0s with T1 D4 framing. The tone is phase shifted between adjacent DS0 channels to prevent Yellow Alarms.
T1ESF 1:7	F01000000.... Pattern is aligned with the T1 ESF framing (F) format as indicated.
T1ESF QRSS	2^{20}-1 bit pseudorandom pattern with 14-zero suppression and T1 ESF framing.
T1ESF 3/24	F0100 0100 0000 0000 0000 0100.... Pattern is aligned with the T1 ESF framing (F) format as indicated.
T1ESF 1004Hz.	1004 Hz tone on all DS0s with T1 ESF framing.

4.8.3 Pattern Synchronization Acquisition Criteria

Pseudorandom Patterns:	60 ÷ n consecutive error-free bits for pattern length 2^n-1.
Fixed Patterns:	64 consecutive error-free bits.

4.9 FRAME SYNCHRONIZATION DETECTION CRITERIA

Frame Sync:	15 consecutive error-free F-bits and 2 consecutive error-free M_0 M, M_0 sequences

Table 4-2. IEEE-488 Connector Pin Assignments

Pin No.	Description	Pin No.	Description
1	Data In/Out 1 (DIO1)	13	Data In/Out 5 (DIO5)
2	Data In/Out 2 (DIO2)	14	Data In/Out 6 (DIO6)
3	Data In/Out 3 (DIO3)	15	Data In/Out 7 (DIO7)
4	Data In/Out 4 (DIO4)	16	Data In/Out 8 (DIO8)
5	End or Identify (EOI)	17	Remote Enable (REN)
6	Data Valid (DAV)	18	Ground for twisted pair for 6
7	Not Ready for Data (NRFD)	19	Ground for twisted pair for 7
8	Not Data Accepted (NDAC)	20	Ground for twisted pair for 8
9	Interface Clear (IFC)	21	Ground for twisted pair for 9
10	Service Request (SRQ)	22	Ground for twisted pair for 10
11	Attention (ATN)	23	Ground for twisted pair for 11
12	SHIELD	24	Signal Ground

4.12 GROUNDING

Chassis and Signal Grounds:	Connected internally.
WECO 560A Jack Sleeves:	Connected to chassis ground.
Power Cord:	Center ground pin connected to chassis ground.
25-pin D Connector:	Pin 1 to chassis ground. Pin 7 to signal ground.

4.13 310-1 DS1/DS0 ANALYZER OPTION

This section contains the specifications for the 310-1 DS1/DS0 Analyzer Option.

4.13.1 Environmental

Operating Temperature Range:	32°F to 113°F (0°C to 45°C).
Storage Temperature Range:	-40°F to 158°F (-40°C to 70°C).
Operating Humidity:	90% maximum, noncondensing.
Storage Humidity:	5% to 95% noncondensing.

4.13.2 T1 Input

Connector:	Bantam (new units) or WECO 310 (old units) jack.
Frequency:	1,544,000 Hz ±5000 Hz.
Impedance:	BRIDGE — 1000 ohms or greater TERM — 100 ohms ±5% DSX MON — 100 ohms ±5%

4.10 RS-232 INTERFACE CONNECTOR

Connector Pin Assignments: See Table 4-1.

Table 4-1. RS-232 Connector Pin Assignments

Pin #	Designation	Direction	Description
1	Prot. Gnd	---	Protective Ground — Connected to chassis ground.
2	TD	IN	Transmitted Data — The T-BERD 310 receives data on this lead.
3	RD	OUT	Received Data — The T-BERD 310 transmits data on this lead.
5	CTS	OUT	Clear to Send — This lead is asserted by the T-BERD 310 when it is ready to receive data. It should be monitored by the DTE to avoid transmitting data too fast to the T-BERD 310
6	DSR	OUT	Data Set Ready — This lead is always ON when power is applied.
7	Sig. Gnd	---	Signal Ground — Connected to signal ground.
8	+ VDC	---	Test Voltage — This lead provides +12 VDC (RS-232 ON).
9	+ VDC	---	Test Voltage — This lead provides +12 VDC (RS-232 ON)
10	- VDC	---	Test Voltage — This lead provides -12 VDC (RS-232 OFF)
12	SRLSD	OUT	Secondary Received Line Signal Detector — This lead is driven ON by the T-BERD 310 when data is being sent.
20	DTR	IN	Data Terminal Ready — When this lead is asserted by the receiving device (e.g., printer), the T-BERD 310 transmits data.

Character Format:	Seven or eight data bits (ASCII coding). Even or odd parity. Two transmitted stop bits. Accepts one or more received stop bits.
Baud Rates:	110, 300, 600, 1200, 2400, 4800, and 9600
Terminator:	CR, LF, and CRLF.
Print Width:	40-column or 80-column.
Connector Configuration:	DCE.
Connector:	25-pin female D.

4.11 IEEE-488 INTERFACE CONNECTOR

This section contains the specifications for the IEEE-488

Connector Type:	24-pin, D-type. DS3 Jitter Amplitude versus Frequency Mask.
Connector Configuration:	Addressable or Talk-Only.
Connector Pin Assignments:	See Table 4-2.
Maximum Transfer Rate:	1200 bytes per second.
Terminator:	CR, LF, or CRLF.

Operating Range:	BRIDGE — +6 to -35 dBdsx cable loss. TERM — +6 to -35 dBdsx cable loss DSX-MON — +6 to -24 dBdsx resistive loss.
Line Code:	AMI or B8ZS. Received B8ZS is automatically decoded.
Jitter Tolerance:	per AT&T PUB 62411, 1983.
T1 Framing Formats:	D4 Superframe, ESF, SLC-96, and Unframed.

4.13.3 T1 Output

Connector:	Bantam (new units) or WECO 310 (old units) jack.
Signal Level:	3 V base-to-peak into a 100-ohm load (0 dBdsx)
Pulse Shape:	With the output terminated into a 100-ohm resistive load (DSX-MON), the 310-1 meets pulse shape specifications given in ITU-T Recommendation G.703, Bell Publications CB113, CB119, CB132, CB143, and AT&T PUB62508; and AT&T PUB62411.
Internal Oscillator Accuracy:	±15 ppm.
Line Code:	AMI or B8ZS
T1 Framing Formats:	D4 Superframe, ESF, SLC-96, and Unframed.

4.13.4 Alarm Criteria

Signal Loss:	150 ms without input pulses after initial signal detected.
Pattern Sync Loss:	QRSS, 2^{15}-1, 2^{20}-1, 2^{23}-1, and 2^{11}-1 — 250 errors in 1000 or fewer bits. 1:1, 1:7, ALL ONES, 3 IN 24, and USER1 — 100 errors in 1000 or fewer bits
Frame Sync Loss:	D4 — two out of five Ft bits in error ESF — two out of five frame bits in error. SLC — two out of four Ft bits in error.
Excess Zeros:	16 or more consecutive zeros with AMI line coding. 8 or more consecutive zeros with B8ZS line coding
Yellow Alarm:	D4 and SLC — Bit 2 is a "0" for 255 consecutive channels. ESF — 256 bits ±16 bits of repetitive 11111111 00000000 pattern received in the datalink.
All Ones:	Unframed — 2048 or more consecutive ones. Framed — 256 consecutive DS0 channels with all ones.

4.13.5 Test Pattern Definitions

1:1	Alternating ones (mark) and zeros (space) pulses.
1:7	F01000000.... A single one and seven zeros pattern. When framed, the pattern is aligned with the F-bits as indicated to prevent false Yellow Alarms.

2^15-1:	32,767-bit pseudorandom pattern generates a maximum of 14 sequential zeros and 15 sequential ones.
2^20-1:	1,048,575-bit pseudorandom pattern generates a maximum of 19 sequential zeros and 20 sequential ones.
2^23-1:	8,388,607-bit pseudorandom pattern generates a maximum of 22 sequential zeros and 23 sequential ones.
2^31-1:	2,147,483,648-bit pseudorandom pattern generates a maximum of 30 sequential zeros and 31 sequential ones.
3 IN 24:	F0100 0100 0000 0000 0000 0100. Pattern synchronized to framing bits to prevent D4 Yellow Alarms or Excess Zeros.
ALL ONES:	All Ones (marks).
ALL ZEROS:	All Zeros (spaces).
QRSS:	Quasi-Random Signal Source. Modified 2^{20}-1 pseudorandom pattern which generates a maximum of 14 sequential zeros and 20 sequential ones.
USER1:	3- to 24-bit programmable pattern; factory setting is 10000.

4.13.6 Pattern Synchronization Acquisition Criteria

Fixed Patterns:	30 consecutive error-free bits.
Pseudorandom Patterns:	30 + n consecutive error-free bits for a pattern length of 2^n-1 (for QRSS, n = 20).

4.13.7 Loop Code Pattern Definitions

In-band Loop Codes:	CSU — Loop up: 10000. Loop down: 100. FACILITY 1 — Loop up: 1100. Loop down: 1110. FACILITY 2 — Loop up: 11000. Loop down: 11100. PROGRAMMABLE — 3- to 8-bit programmable pattern for both loop codes.
ESF Out-of-Band Loop Codes:	LINE — Loop up: 1111 1111 0111 0000. Loop down: 1111 1111 0001 1100. PAYLOAD — Loop up: 1111 1111 0010 1000. Loop down: 1111 1111 0100 1100. NETWORK — Loop up: 1111 1111 0100 1000. Loop down: 1111 1111 0010 0100.

4.13.8 Loop-Code Detection Criteria

In-band Loop Codes:	Loop Up — Continuously transmitted until the code is received error-free for 250 ms or the switch is pressed a second time. Loop Down — Continuously transmitted until the code is no longer received or the switch is pressed a second time.
ESF Out-of-Band Loop Codes:	Not detectable. However, the loop codes are transmitted for only 1 second.

4.13.9 DS1 Frequency Measurement

Accuracy:	±15 ppm.
Resolution:	1 Hz.

4.13.10 DS1 Timing Slips Measurement

Range:	0 bit slips to 999 frame slips and 192 bit slips.
Resolution:	1 bit slip.

4.13.11 DS1 Level Measurement

Range:	+6 dBdsx to -40 dBdsx.
Accuracy:	±1.0 dB between +6 dBdsx and -18 dBdsx. ±2.0 dB between -18 dBdsx and -40 dBdsx.
Resolution:	0.1 dBdsx.

4.13.12 VF Level Measurement

Range:	+3 dBm0 to -50 dBm0.
Accuracy:	±0.3 dBm.
Resolution:	0.01 dBm.

4.13.13 DATAPORT Interface

Connection:	9-position, 6-pin, female D connector.
Configuration:	Synchronous DCE (transmit only).
Pin Assignments:	See Table 4-3.
Data Format:	DS0 or datalink.
Data Output:	DS0 — 56 and 64 kb/s clear channel. ESF — 4 kb/s datalink. SLC — 4 kb/s datalink and Fs bits (external decoding required).
Timing:	Recovered clock from received data on DS1 RECEIVE jack. Attached test set must synchronize to clock source on Pin 9. Output is squelched until the instrument is synchronized with framing bits.
Control Level:	+12 VDC for ON (0) and -12 VDC for OFF (1).
Output Signal Level:	+12 VDC for a space (0) and -12 VDC for a mark (1).
Clock Signal Level:	±12 VDC.

Table 4-3. DATAPORT Connector Pin Assignments

Pin #	Designation	Description
1	Signal Ground	Connected to signal ground.
5	Control	This lead is ON when the output signal (pin 6) is available.
6	Output Signal	This lead provides 64 or 56 kb/s DS0 channel, SLC-96 4 kb/s datalink, or ESF 4 kb/s datalink signals. The output is controlled through the AUX-DATAPORT auxiliary function and **MODE** switch.
9	Clock Signal	This lead provides an external clock source for the attached test set.

4.13.14 Voice Frequency Output

Connection:	Bantam (new units) or WECO 310 (old units) jack.
Impedance:	600 ohms resistive.
Level:	Calibrated to dBm0 = 0 dBm.

4.14 310-3 DS1 INSERT/SECONDARY DS3 RECEIVE OPTION

This section contains the specifications for the 310-3 DS1 Insert Option.

4.14.1 DS1 Insert Input Specifications

Connector	Bantam (new units) or WECO 310 (old units) jack.
Frequency	1,544,000 Hz ±1000 Hz.
Impedance	100 ohms ±5%, balanced to ground.
Signal Level Range	+6 to -6 dBdsx cable loss. +6 to -26 dBdsx resistive loss.
Jitter Tolerance	per AT&T PUB62411, 1983.

4.14.2 Secondary DS3 Receive Specifications

Connector	WBCO 560A jack.
Frequency	44.736 Mb/s ±1000 Hz.
Impedance	75 ohms ±5%, unbalanced to ground.
Line Code	B3ZS.

4.15 SONET OPTIONS

This section contains the specifications for the SONET options 310-12, 310-13R, 310-14R 310-13T, 310-14T, and 310-21.

4.15.1 STS-1 Receive Signal (310-13R or 310-14R Option)

Connector	Standard — WECO 560A jack. Optional — BNC jack.
Frequency	51.840 Mb/s ±200 ppm.
Impedance	75 ohms ±5%, unbalanced to ground.
Line Code	B3ZS.
Signal Level Range	DSX — Up to 3 dB of cable loss or 20 dB of resistive attenuation from a nominal DSX level. HIGH — Up to 3 dB of cable loss or 20 dB of resistive attenuation from a nominal HIGH level.

4.15.2 STS-1 Transmit Signal (310-13T or 310-14T Option)

Connector	Standard — WECO 560A jack. Optional — BNC jack.
Frequency	51.840 Mb/s ±15 ppm (internal timing).
Impedance	75 ohms ±5%, unbalanced to ground.
Line Code	B3ZS.
Signal Level Range	HIGH — Nominal rectangular pulse with an amplitude of 1.03 Vp ±10% and a maximum undershoot and overshoot of less than 10%. Signal meets ANSI specification T1.102 STS-1 Eye Diagram Mask after passing through 450 feet of 728A cable. DSX — Amplitude of 0.516 Vp ±10%. Signal meets ANSI specification T1.102 Eye Diagram Mask for STSX-1 Interconnection.

4.15.3 OC-1 and OC-3 Receive Signal (310-14R Option)

Connector:	Standard — PC(PC). Optional — ST or SC.
Frequency:	OC-1 — 51.840 Mb/s ±200 ppm. OC-3 — 155.520 Mb/s ±200 ppm (tested to ±6 ppm with resolution of 10 Hz).
Optical Input:	1310 and 1550 nm, 50/125 multimode pigtail.
Input Power Range:	-35.0 dBm to -7.0 dBm with a 10^{-10} error rate on a 2^{23}-1 pattern, unscrambled.

4.15.4 OC-1 and OC-3 Transmit Signal (310-14T Option)

Connector:	Standard — FC(PC). Optional — ST or SC.
Frequency:	OC-1 — 51.840 Mb/s ±15 ppm (internal timing). OC-3 — 155.520 Mb/s ±15 ppm (internal timing)
Optical Wavelength:	Standard — 1310 nm, intermediate reach. Optional — 1550 nm, intermediate reach.
Output Power Range:	-15.0 dBm to -8.0 dBm.

4.15.5 OC-12 Receive Signal (310-12 Option)

Connector:	Standard — FC(PC). Optional — ST or SC.
Frequency	OC-12 — 622.080 Mb/s ±50 ppm.
Optical Input	1310 and 1550 nm, 50/125 multimode pigtail.
Input Power Range	-26.0 dBm to -8.0 dBm with a 10-10 error rate on a 2^{23}-1 pattern, unscrambled.

4.15.6 OC-12 Transmit Signal (310-12 Option)

Connector:	Standard — FC(PC). Optional — ST or SC.
Frequency:	OC-12 — 622.080 Mb/s ±15 ppm (internal timing).
Optical Wavelength:	Standard — 1310 nm, intermediate reach. Optional — 1550 nm, intraoffice access.
Output Power Range:	-14.0 dBm to -4.0 dBm.

4.15.7 SONET DCC Drop and Insert Signal (310-13R or 310-14R Option)

Connector	15-pin D.
Pin Assignments	See Table 4-4. Pin assignments for the RS-449 15- to 37-pin cable (Model 42836) are also provided.

Table 4-4. SONET DCC Pin Assignments

15-Pin D Connector	37-Pin D Connector	Description
1	4	Send Timing (a)
2	26	Receive Timing (b)
3		NC
4	22	Send Data (b)
5	4	Send Data (a)
6	6	Receive Data (a)
7		NC

4.15.11 OC-48 Transmit Signal (310-21 Option)

Connector:	Standard — FC(PC). Optional — ST or SC.
Frequency:	OC-48 — 2488.32 Mb/s ±15 ppm (internal timing).
Optical Wavelength:	Standard — 1310 nm, intermediate reach. Optional — 1550 nm, intraoffice access. Dual Optional — 1310/1550 nm for dual optics access.
Output Power Range:	+2.78 dBm to -2.60 dBm for high power output. -10.00 dBm to -16.70 dBm for low power output.

4.16 310-5 DS3 JITTER OPTION

This section contains the specifications for the 310-5 DS3 Jitter Option.

4.16.1 General Specifications

Input Signal	Jitter clock recovered from the DS3 RECEIVE jack.
Time Base Range	44.736 MHz ±4.4 kHz (= ±100 ppm)
Acquisition Time	After a valid jitter clock is present 2 to 4 seconds (typical), 12 seconds (maximum)
Amplitude Measurement Interval:	0.25 seconds.
Warm-up Interval:	3 minutes.

4.16.2 Jitter Amplitude Measurements Specifications

Dynamic Range:	2 UI Scale — < 2.000 UI p-p 5 UI Scale — < 5.00 UI p-p. 20 UI Scale — < 20.00 UI p-p.
Frequency Measurement Range:	See Figure 4-1.
Resolution:	2 UI Scale — 0.005 UI. 5 UI Scale — 0.01 UI. 20 UI Scale — 0.02 UI.
Accuracy:	2 UI Scale — ±5% ±0.05 UI. 5 UI Scale — ±5% ±0.125 UI. 20 UI Scale — ±5% ±0.5 UI.
Bandwidths:	Wideband — 10 Hz to 400 kHz, nominal. Highband — 30 kHz to 400 kHz, nominal. Filter slopes — 20 dB/decade. The filter response at the corner frequencies is nominally down 3 dB from the center of the passband.

Table 4-4. SONET DCC Pin Assignments (Continued)

15-Pin D Connector	37-Pin D Connector	Description
8	17	Terminal Timing (a)
9	23	Send Timing (b)
10	8	Receive Timing (a)
11	20	Receiver Common
12	24	Receive Data (b)
13		NC
14	35	Terminal Timing (b)
15	37	Send Common

4.15.8 SONET Orderwire Handset Signal (310-13T or 310-14T Option)

Connector:	RJ-11
Pin Assignments:	See Table 4-5. Handset, Model 11255, matches the pin assignments.

Table 4-5. Orderwire Pin Assignments

Pin	Description	Pin	Description
1	TX1	3	RX1
2	TX2	4	RX2

4.15.9 DS1 BITS Clock Input Signal (310-13T or 310-14T Option)

Connector:	Bantam jack.
Frequency:	1.544 MHz ±130 ppm.
Impedance:	TERM — 100 ohms ±5%, balanced tip to ring. BRIDGE — 1000 ohms or greater, balanced tip to ring.
Signal Level Range:	+2 to -10 dBdsx.
Jitter Tolerance:	Per AT&T PUB 62411, 1983.

4.15.10 OC-48 Receive Signal (310-21 Option)

Connector:	Standard — FC(PC). Optional — ST or SC.
Frequency:	OC-48 — 2488.32 Mb/s ±50 ppm.
Optical Input:	1310 and 1550 nm, 50/125 multimode pigtail.
Input Power Range:	-28.0 dBm to -9.0 dBm with a 10-10 error rate on a 2^{23}-1 pattern, unscrambled.

4.16.3 Jitter Frequency Output Specifications

Connector:	BNC.
Impedance:	50 ohms.
Demodulated Analog Signal Output:	2 UI Scale — 0.5 Vp-p/UIp-p. 5 UI Scale — 0.2 Vp-p/UIp-p 20 UI Scale — 0.05 Vp-p/UIp-p.
Bandwidths:	Wideband — 10 Hz to 400 kHz, nominal. Highband — 30 kHz to 400 kHz, nominal. Filter slopes — 20 dB/decade. The filter response at the corner frequencies is nominally down 3 dB from the center of the passband.

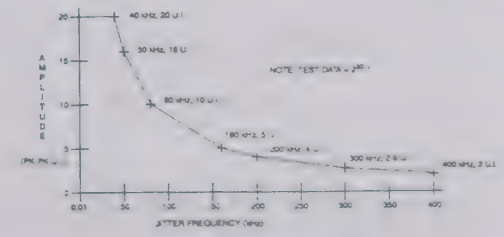


Figure 4-1. DS3 Jitter Tolerance Mask

4.17 310-10 G.821 RESULTS OPTION

This section contains the specifications for the 310-10 G.821 Results Option.

Compatibility:	Meets ITU-T Recommendation G.821.
Available Results:	Available seconds, % available seconds, severely errored seconds (except the 310-1), % severely errored seconds, consecutive severely errored seconds (except the 310-1), degraded minutes, % degraded minutes, and unavailable seconds

4.18 310-16 OPTICAL MEDIA TEST OPTION

This section contains the specifications for the 310-16 Optical Media Test Option.

4.18.1 Optical Power Meter

Connector:	Standard — FC(PC). Optional — ST or SC.
Measurement Range:	+3 dBm to -50 dBm.
Resolution:	0.1 dB.
Accuracy:	±0.7 dB.
Optical Wavelengths:	1310 nm ±30 nm or 1550 nm ±30 nm.

4.18.2 Optical Return Loss Meter Measurement

Measurement Range:	8 dB to 45 dB.
Resolution:	1.0 dB.
Accuracy:	±3 dB.
Optical Wavelengths:	1310 nm ±30 nm or 1550 nm ±30 nm.

4.18.3 Optical Stable Source

Connector:	Standard — FC(UPC). Optional — ST or SC.
Optical Wavelengths:	1310 nm ±30 nm or 1550 nm ±30 nm.
Output Power:	-10 dBm ±0.2 dB.
Power Stability:	0.05 dB after 5 mins @ 25°C.

4.19 ATM ANALYSIS OPTIONS

This section contains specifications for the ATM analysis options, 310-15, 310-17A, and 310-20.

4.19.1 Receive Modes

Search:	Analyzer locates cells by payload type and reports address (e.g., TTC test cell, OAM AIS, OAM RDI).
Preview:	Analyzer reports all active addresses, respective of bandwidth and cell type.
Test Mask:	Analyzer filters up to five user-programmable receive header masks and reports detailed results on incoming cells fitting the specification.

4.19.2 ATM Generator

Network Interfaces:	UNI and NNI header formats. Selectable cell payload scrambling.
Cell Mapping:	Up to 100% of the payload can be mapped with any combination of foreground test cells, multiple background cells, and idle cells. HEC or PLCP (DS1 and DS3 ATM signal) alignment format is used to generate ATM cells.
Profiles:	Four independent hex- or decimal-programmable cell headers are available. Flexibility includes GFC, VPI, VCI, PTI, CLP, and programmable bandwidths.
Burst Mode:	Up to 100% bandwidth for up to 9.9 full seconds can be configured as a burst pattern.
Error and Alarm Insertion:	Non-correctable and correctable HEC errors can be inserted in single, rate, burst, and continuous formats. PLCP BIP errors are insertable in single and rate formats (DS1 and DS3 ATM signal). OAM cell transmission allow ATM AIS and RDI alarm generation.

4.19.3 ATM Analyzer

Network Interfaces:	UNI and NNI header formats Selectable cell payload descrambling.
Cell Mapping:	HEC or PLCP (DS1 and DS3 ATM signal) alignment cell delineation is used to detect ATM cells. Analysis on 100% of traffic bandwidth.

SECTION 5
TTC CUSTOMER SERVICES

5.1 INTRODUCTION

TTC offers unmatched services to support purchased equipment, including a wide range of customer care, technical support, instrument maintenance, and training services. TTC customer service specialists are fully trained to help customers find the answers they are looking for. Call Customer Services for:

- Information on products and services, including upgrades, calibration, training, software enhancement agreements (SEAs), and product maintenance agreements. Our representatives can also provide assistance with product returns and repairs.
- Expert technical support, including help with product configuration, circuit qualification, and complete network trouble sectionalization. TTC is also available on a contractual basis to provide customized application development, network consulting and management services, software customization, and test procedure development.

All TTC products are backed by an industry-leading warranty that guarantees mainframe repair or replacement for 3 years and all other parts for 1 year.

5.2 CUSTOMER SERVICE LOCATIONS

For questions regarding TTC products and services, including return authorizations and repairs, technical support, training, and all other available services, contact your local distributor or TTC Customer Service at one of the locations listed in the TTC Worldwide Contact list at the beginning of the manual.

5.3 SERVICES

5.3.1 Instrument Service

To maintain your organization's long-term investment, TTC will structure a service plan to fit your network performance goals and budget. TTC understands the impact of equipment down time on operations and is staffed to ensure a quick turnaround. Available services include:

Product Repair — All equipment returned for service is tested to the same rigorous standards as newly manufactured equipment. This ensures products meet all published specifications, including any applicable product updates.

Calibration — TTC's calibration methods are ISO 9001 approved and based on NIST standards. Each calibration comes with a dated certificate, instrument stickers, and a data sheet.

Factory Upgrades — Any unit returned for a hardware feature enhancement will also receive applicable product updates and will be thoroughly tested, ensuring peak performance of the complete feature set.

Software Enhancement Agreements — These agreements assist in keeping equipment up to date with the latest software features, by providing automatic notification of any new software enhancements and changes for TTC products.

Product Maintenance Agreements — Yearly service and calibration maintenance agreements simplify billing and help ensure the equipment is always operating at optimum levels. Product maintenance agreements can be used to extend a current warranty or provide protection for out-of-warranty units.

Other Pricing Options — For out-of-warranty repairs, TTC offers two additional pricing options: time and material pricing and flat rate pricing. Under time and material pricing, customers are billed for the actual cost of the repair, making this a cost-effective method for minor repairs. Under flat rate pricing, customers pay a fixed service charge to repair unit failures (excluding damage or abuse), resulting in simplified paperwork and easier budgeting.

5.3.2 Product Enhancement Group

The Product Enhancement Group staff offers one of the broadest and most experienced resource portfolios in the communications testing industry. This team of professionals offers expertise in software development, test procedure development, and network consulting, as well as years of expert test knowledge. Support is available for all core TTC product lines:

Network Consulting and Management — Provides services such as productivity analysis, test strategy assessment, on-site applications assistance, and specialized training.

Software Customization — Develops scripts for remote and automated testing, statistics, and emulation.

Test Procedure Development — Creates procedures for automated testing, network testing, and compliance testing.

5.3.3 Test Systems Field Engineering and Installation

TTC offers a range of support services for our centralized test systems, designed around the needs of the customer's network. These services help preserve the investment over the life of the equipment. Available services include:

Critical Services Program — Provides technical support at any time, 7 days a week, 24 hours a day. Replacement parts are guaranteed to arrive within 48 hours of contacting TTC.

Maintenance Contracts — Cost-effective management for networks with multiple test systems.

Out-of-Warranty Service Agreement — Covers the test system for failures after the warranty expires, including all time and material costs and return shipping costs to the customer site.

Field Engineering and Installation Service — Provides a variety of options for implementing the test system into the network, including installation, configuration, upgrades, and on-site technical support.

5.3.4 Technical Training

By providing both experienced instructors and a hands-on atmosphere, TTC training is designed to optimize test strategies and employee development requirements. Available services include:

Customized Technical Training — Designed to incorporate real-life challenges technicians face daily, while addressing the customer's training requirements, TTC provides training at the customer's designated site, so the whole staff is trained at one time. Step-by-step reviews of current technologies and products enable new or experienced technicians to translate theory into practical, hands-on expertise.

Public Courses — Regularly scheduled, in-depth, hands-on product and technology courses are offered worldwide. Public courses provide a learning environment that allows individuals from different companies to share their knowledge and experience with their peers.

Computer-Based Training (CBT) — TTC's CBT complements our hands-on technical training. With CBT, customers can learn about emerging communications technologies at their own convenience — at work, at home, or while traveling. TTC's CBT courses cover technology topics such as ATM, frame relay, ISDN, LAN basics, and more.

Customized Multimedia Course Development — Multimedia courseware can be created to customer specifications, making it easier to learn new test instruments or applications. These custom packages provide consistent educational content and training for the entire staff. Students learn at their own pace on their own PC.

Consulting and Needs Analysis Services — TTC can help identify training needs and develop customized training curricula to maximize learning opportunities, all while providing a measurable return on investment.

5.4 WARRANTY INFORMATION

5.4.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Mainframes will be repaired or replaced (at TTC's option) at no charge for a period of three (3) years after shipment to the customer. All other equipment, including batteries, will be repaired or replaced (at TTC's option) at no charge for a period of one (1) year after shipment to the customer. Contact TTC Customer Service to determine your equipment warranty status.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions.

(1) Equipment has been altered or repaired without specific authorization from TTC.

(2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

(6) The return authorization (RA) number (US customers), or reference number (European Customers)

If possible, return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit when needed, appropriate packing materials can be obtained by contacting TTC Customer Services. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA or reference number on the outside of the package and ship it prepaid and insured to TTC.

No other warranty is expressed or implied. TTC is not liable for any direct, indirect, incidental, or consequential damages.

5.5 SERVICE AND REPAIR INFORMATION

5.5.1 In-Warranty Service

Equipment in warranty must be returned to the factory or authorized service center with shipping prepaid. The equipment should be packed and shipped in accordance with the *Equipment Return Instructions on page 4*. Before returning any equipment, the customer must obtain a return authorization (RA) number (reference number - European Customers) by contacting TTC Customer Service (*see page 1*), or the TTC office serving your region (call or visit our website for a current list of worldwide TTC locations). The RA or reference number should appear on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it is tested to applicable specifications and returned to the customer with shipping prepaid. A detailed description of the work performed and parts replaced will be provided with each repair.

5.5.2 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as the one used for equipment still in warranty. There is a minimum charge applied to each request for out-of-warranty service. The charge guarantees the customer an estimate of the repair costs and is used as credit against the actual repair costs should the equipment be repaired. There are three payment methods available for out-of-warranty service: service agreement, flat rate, and time and material. Contact TTC Customer Services or visit our website for more information on these options.

The customer will be required to furnish a purchase order number before repair work can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment may be shipped to the customer. A detailed description of the work performed and parts replaced will be provided with each repair.

Once an out-of-warranty repair is made, the repaired part or component is warranted for one (1) year. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the one (1) year repair warranty.

5.5.3 Equipment Return Instructions

For each piece of equipment returned for repair, attach a tag that includes the following information:

(1) Owner's name, address, and telephone number.

(2) The serial number, product type, and model.

(3) Warranty status. (If you are unsure of the warranty status of your instrument, contact TTC Customer Service.)

(4) A detailed description of the problem or service requested.

(5) The name and telephone number of the person to contact regarding questions about the repair.

APPENDIX A
OPERATING MESSAGES

A.1 INTRODUCTION

This appendix lists the printed status, alarm, and note messages; the messages that appear on the front panel; and error and warning messages generated during local and remote control operation. These messages are divided by mainframe and option.

A.2 PRINTED STATUS, ALARM, AND NOTE MESSAGES

These messages are identified as status, alarm, and note messages. They are generated automatically when an important condition occurs. Set the **PRINT EVENT** switch to a selection other than OFF to generate these messages. The two-line message format includes the message type (status, alarm, or note), time, date, the number of times the condition occurs (i.e., it keeps counting even if not reported) over the course of the test, and the message identifying the reported condition.

A.2.1 Status Messages

The status messages indicate positive conditions in the received signal and relate to the Status LEDs. The Status messages start with the **** STATUS:* header.

A.2.1.1 T-BERD 310 Mainframe

DS3 FEAC Pri LPDN All DS1 — A DS1 FEAC loop-down code for all DS1 channels is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPDN DS1 n — A DS1 FEAC loop-down code for DS1 channel n (n = 1 to 28) is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPDN DS3 NIU — A DS3 FEAC loop-down code for an NIU is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPDN DS3 — A DS3 FEAC loop-down code is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPUP All DS1 — A DS1 FEAC loop-up code for all DS1 channels is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPUP DS1 n — A DS1 FEAC loop-up code for DS1 channel n (n = 1 to 28) is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPUP DS3 NIU — A DS3 FEAC loop-up code for an NIU is detected in the received Primary DS3 signal.

DS3 FEAC Pri LPUP DS3 — A DS3 FEAC loop-up code is detected in the received Primary DS3 signal.

DS3 Primary C-Bit Frame Sync — The DS3 C-bit parity framing format is detected in the received Primary DS3 signal.

DS3 Primary DS2 Frame Sync — The DS2 framing format is detected in the received Primary DS3 signal.

DS3 Primary Frame Sync — The DS3 framing format is detected in the received Primary DS3 signal.

DS3 Primary Idle Detect — The DS3 Idle Signal is detected in the received Primary DS3 signal.

DS3 Primary Pattern Sync — The DS3 test pattern is recognized in the received Primary DS3 signal.

DS3 Primary Signal Present — DS3 pulses of a valid frequency and level are present in the received Primary DS3 signal.

A.2.1.2 310-1 DS1/DS0 Analyzer Option

DS1 B8ZS Detect — B8ZS encoding is detected in the received DS1 signal.

DS1 Frame Sync — The DS1 framing format is detected in the received DS1 signal.

DS1 Pattern Sync — The DS1 test pattern is recognized in the received DS1 signal.

T1 Pulses — DS1 pulses of a valid frequency and level are present in the received DS1 signal.

A.2.1.3 310-3 DS1 Insert Option

DS3 FEAC Sec LPDN All DS1 — A DS1 FEAC loop-down code for all DS1 channels is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPDN DS1 n — A DS1 FEAC loop-down code for DS1 channel n (n = 1 to 28) is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPDN DS3 NIU — A DS3 FEAC loop-down code for an NIU is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPDN DS3 — A DS3 FEAC loop-down code is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPUP All DS1 — A DS1 FEAC loop-up code for all DS1 channels is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPUP DS1 n — A DS1 FEAC loop-up code for DS1 channel n (n = 1 to 28) is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPUP DS3 NIU — A DS3 FEAC loop-up code for an NIU is detected in the received Secondary DS3 signal.

DS3 FEAC Sec LPUP DS3 — A DS3 FEAC loop-up code is detected in the received Secondary DS3 signal.

DS3 Sec C-Bit Frame Sync — The DS3 C-bit parity framing format is detected in the received Secondary DS3 signal.

DS3 Secondary DS2 Frame Sync — The DS2 framing format is detected in the received Secondary DS3 signal.

DS3 Secondary Frame Sync — The DS3 framing format is detected in the received Secondary DS3 signal.

DS3 Secondary Idle Detect — The DS3 Idle Signal is detected in the received Secondary DS3 signal.

DS3 Secondary Signal Present — DS3 pulses of a valid frequency and level are present in the received Secondary DS3 signal.

A.2.1.4 310-12, 310-13R/T, 310-14R/T, or 310-21 SONET Option

SONET Frame Sync — SONET frame synchronization is established with the received SONET signal.

SONET Path Pointer Present — A valid SONET path pointer is detected in the received SONET signal.

SONET Signal Present — The SONET signal is detected at the selected SONET input.

SONET VT Pointer Present — A valid SONET VT pointer is detected in the received SONET signal.

A.2.2 Alarm Messages

The alarm messages indicate negative conditions in the received signal and relate to the current Alarm LEDs. The Alarm messages start with the **** ALARM:* header.

A.2.2.1 T-BERD 310 Mainframe

DS3 FEAC Pri AIS RX — A DS3 Alarm Indication Signal Received message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 AIS RECEIVED* message.

DS3 FEAC Pri Comm EF NSA — A Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Primary DS3 signal. This is the same as the front panel *COMM EQUIP FAIL (NSA)* message.

DS3 FEAC Pri DS1 EF NSA — A DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Primary DS3 signal. This is the same as the front panel *DS1 EQUIP FAIL (NSA)* message.

DS3 FEAC Pri DS1 EF SA — A DS1 Equipment Failure, Service Affecting (Type 1 equipment failure) message is detected in the received Primary DS3 signal. This is the same as the front panel *DS1 EQUIP FAIL (SA)* message.

DS3 FEAC Pri EF NSA — A DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 EQUIP FAIL (NSA)* message.

DS3 FEAC Pri EF SA — A DS3 Equipment Failure, Service Affecting (Type 1 equipment failure) message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 EQUIP FAIL (SA)* message.

DS3 FEAC Pri Idle RX — A DS3 Idle Signal Received message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 IDLE RECEIVED* message.

DS3 FEAC Pri L/H — A DS3 Loss-of-Signal/High Bit Error Ratio message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 LOS/HBER* message.

DS3 FEAC Pri Mult DS1 L/H — A Multiple DS1 Loss-of-Signal/High Bit Error Ratio message is detected in the received Primary DS3 signal. This is the same as the front panel *MULT DS1 LOS/HBER* message.

DS3 FEAC Pri OOF — A DS3 Out-of-Frame, Loss of DS3 Frame Synchronization message is detected in the received Primary DS3 signal. This is the same as the front panel *DS3 OUT OF FRAME* message.

DS3 FEAC Pri Sing DS1 L/H — A Single DS1 Loss-of-Signal/High Bit Error Ratio message is detected in the received Primary DS3 signal. This is the same as the front panel *SINGLE DS1 LOS/HBER* message.

DS3 Primary Blue (AIS) — The DS3 Blue Alarm is detected in the received Primary DS3 signal.

DS3 Primary DS2 Frame Lose — The DS2 framing format is no longer present in the received Primary DS3 signal.

DS3 Primary Far-End Alarm — The T-BERD 310 is receiving a DS3 Far-End Alarm and Control (FEAC) condition in the received Primary DS3 signal.

DS3 Primary Frame Loss — The DS3 framing format is no longer present in the received Primary DS3 signal.

DS3 Primary Pattern Loss — The DS3 test pattern is no longer present in the received Primary DS3 signal.

DS3 Primary Signal Loss — Valid DS3 pulses are no longer present in the received Primary DS3 signal.

DS3 Primary Yellow — The DS3 Yellow Alarm is detected in the received Primary DS3 signal.

A.2.2.2 310-1 DS1/DS0 Analyzer Option

DS1 All Ones — An All Ones pattern is detected in the received DS1 signal.

DS1 Excess Zeros — Excess zeros are present in the received DS1 signal.

DS1 Frame Loss — The DS1 framing format is no longer present in the received DS1 signal.

DS1 Pattern Loss — The DS1 test pattern is no longer present in the received DS1 signal.

DS1 Signal Loss — Valid DS1 pulses are no longer present in the received DS1 signal.

DS1 Yellow Alarm — The DS1 Yellow Alarm is detected in the received DS1 signal.

A.2.2.3 310-3 DS1 Insert Option

DS3 FEAC Sec AIS RX — A DS3 Alarm Indication Signal Received message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 AIS RECEIVED* message.

DS3 FEAC Sec Comm EF NSA — A Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Secondary DS3 signal. This is the same as the front panel *COMM EQUIP FAIL (NSA)* message.

DS3 FEAC Sec DS1 EF NSA — A DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS1 EQUIP FAIL (NSA)* message.

DS3 FEAC Sec DS1 EF SA — A DS1 Equipment Failure, Service Affecting (Type 1 equipment failure) message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS1 EQUIP FAIL (SA)* message.

DS3 FEAC Sec EF NSA — A DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 EQUIP FAIL (NSA)* message.

DS3 FEAC Sec EF SA — A DS3 Equipment Failure, Service Affecting (Type 1 equipment failure) message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 EQUIP FAIL (SA)* message.

DS3 FEAC Sec Idle RX — A DS3 Idle Signal Received message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 IDLE RECEIVED* message.

DS3 FEAC Sec L/H — A DS3 Loss-of-Signal/High Bit Error Ratio message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 LOS/HBER* message.

DS3 FEAC Sec Mult DS1 L/H — A Multiple DS1 Loss-of-Signal/High Bit Error Ratio message is detected in the received Secondary DS3 signal. This is the same as the front panel *MULT DS1 LOS/HBER* message.

DS3 FEAC Sec OOF — A DS3 Out-of-Frame, Loss of DS3 Frame Synchronization message is detected in the received Secondary DS3 signal. This is the same as the front panel *DS3 OUT OF FRAME* message.

DS3 FEAC Sec Sing DS1 L/H — A Single DS1 Loss-of-Signal/High Bit Error Ratio message is detected in the received Secondary DS3 signal. This is the same as the front panel *SINGLE DS1 LOS/HBER* message.

DS3 Secondary Blue (AIS) — The DS3 Blue Alarm is detected in the received Secondary DS3 signal.

DS3 Secondary DS2 Frame Loss — The DS2 framing format is no longer present in the received Secondary DS3 signal

DS3 Secondary Far-End Alarm — The T-BERD 310 is receiving a DS3 Far-End Alarm and Control (FEAC) condition in the received Secondary DS3 signal.

DS3 Secondary Frame Loss — The DS3 framing format is no longer present in the received Secondary DS3 signal.

DS3 Secondary Pattern Loss — The DS3 test pattern is no longer present in the received Secondary DS3 signal.

DS3 Secondary Signal Loss — Valid DS3 pulses are no longer present in the received Secondary DS3 signal.

DS3 Secondary Yellow — The DS3 Yellow Alarm is detected in the received Secondary DS3 signal.

A.2.2.4 310-12, 310-13R/T, 310-14R/T, or 310-21 SONET Option

SONET Line AIS — A Line AIS is detected in the received SONET signal.

SONET Line RDI — A Line RDI is detected in the received SONET signal.

SONET Loss of Frame — SONET frame synchronization is no longer present between test instrument and the received SONET signal.

SONET Loss of Signal — The SONET signal is no longer detected.

SONET Path AIS — A Path AIS is detected in the received SONET signal.

SONET Path LOP — A Path LOP is detected in the received SONET signal.

SONET Path RDI — A Path RDI is detected in the received SONET signal.

SONET Severely Errored Frame — A severely errored frame is detected in the received SONET signal.

SONET VT AIS — A VT AIS is detected in the received SONET signal.

SONET VT LOP — A VT LOP is detected in the received SONET signal.

SONET VT RDI — A VT RDI is detected in the received SONET signal.

A.2.3 Note Messages

The note messages indicate conditions affecting the T-BERD 310 operation. The Note messages start with the **** NOTE:* header.

A.2.3.1 T-BERD 310 Mainframe

DS2 Test Restart — A DS2 test restart occurred on the T-BERD 310 when the DS1 channel and DS2 M-frame changed.

DS3 New Configuration — The configuration of the T-BERD 310 has been modified.

DS3 Test Complete — The end of a timed test has been reached on the T-BERD 310.

DS3 Test Restart — A test restart occurred on the T-BERD 310.

Print Buffer Full — The T-BERD 310 print buffer has overflowed. When the message appears, at least one printout has been lost (discarded). There is no date and time associated with this note message.

Squelch Off — The generation of 5 or less errored second, alarm, note, or status print requests occurred during the previous 60 seconds while the printer squelch was on.

Squelch On — More than 20 errored second, alarm, note, or status printouts have been generated within 60 seconds. The printer squelch is turned on and no more messages or automatic ERR SEC result printouts are printed or stored.

A.2.3.2 310-1 DS1/DS0 Analyzer Option

DS1 New Configuration — The configuration of the 310-1 has been modified.

DS1 Test Complete — The end of a timed test has been reached on the 310-1.

DS1 Test Restart — A test restart occurred on the 310-1.

A.2.3.3 310-12, 310-13R/T, 310-14R/T or 310-21 SONET Option

SONET Test Restart — A test restart occurred on a SONET option.

A.3 FRONT-PANEL MESSAGES

Operating messages provide visual indications of the instrument operation and the received signal. Some messages are displayed once and others flash until the cause of the condition is changed or corrected. The messages are defined in alphabetical order as follows:

A.3.1 T-BERD 310 Mainframe

232 REMOTE CONTROL — This message is flashed when the unit is under remote control. This message alternates with the displayed results and operating status. This message is disabled by exiting the remote control mode and returning to local control.

485 REMOTE CONTROL — This message is flashed when the unit is under remote control. This message alternates with the displayed results and operating status. This message is disabled by exiting the remote control mode and returning to local control.

DS2 TEST RESTART — This message is flashed when the **DS1 DROP CHANNEL** switch changes the DS1 channel from one DS2 M-frame to another.

OPTION NOT INSTALLED — This message is displayed when an option, which is not currently installed, is required for a switch to operate properly.

SIGNAL LOSS — This message is flashed when the unit loses the DS3 signal.

TIMED TEST COMPLETE — This message is displayed when a timed test is finished. This message is disabled by setting the **TEST** switch to CONT, or by pressing the **RESTART** switch. This message is flashed alternating with the displayed results and operating status.

NO DS3 SIG TRY STS-1 — This message appears when the signal connected to the PRIMARY DS3 RECEIVE jack has a frequency outside the recoverable range of the DS3 receiver. The signal may be confused with an STS-1 SONET signal. Try connecting this signal to the side panel STS-1 RECEIVE connector of the SONET option, if installed.

A.3.2 310-1 DS1/DS0 Analyzer Option

SIGNAL LOSS — This message is flashed when the 310-1 loses the DS1 signal.

TEST COMPLETE — This message is displayed when a timed test is finished. This message is disabled by setting the **TEST** switch to CONT, or by pressing the **RESTART** switch. This message is flashed alternating with the displayed results and operating status.

A.3.3 310-12, 310-13R/T, 310-14R/T, or 310-21 SONET Option

LASER DISABLED — This message appears when the T-BERD 310 is first turned to indicate the optional laser is disabled. Enable the laser through the SONET OUTPUT auxiliary function.

LASER OVERHEATED — This message appears when the optional lasers have malfunctioned. Contact TTC for assistance.

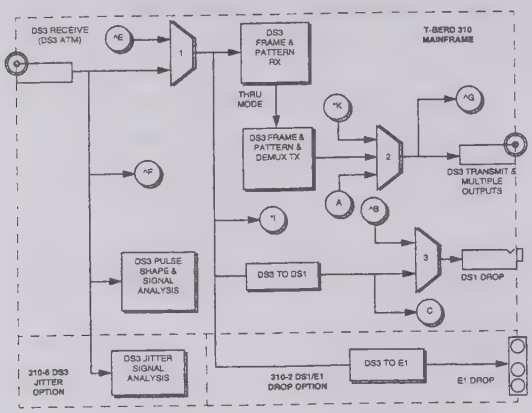
NO STS SIG TRY DS3 — This message appears when the signal connected to the STS-1 RECEIVE connector on the side panel of the SONET options is outside the recoverable frequency range of the STS-1 receiver. The signal may be a DS3 signal. Try connecting this signal to the PRIMARY DS3 RECEIVE jack.

APPENDIX B
T-BERD 310 FUNCTIONAL BLOCK DIAGRAM

B.1 INTRODUCTION

The T-BERD 310 Functional Block Diagram provides a quick and easy reference for following each SONET, DS3, DS1, and DS0 signal path throughout the T-BERD 310. The diagram shows signal input jacks and the functions that can be performed on each signal. The diagram also indicates the functional locations where lower level channels can be dropped from higher level signals (e.g., dropping a DS1 channel from a DS3 signal). Front-panel switches or auxiliary functions required to make any selections are identified on the diagram.

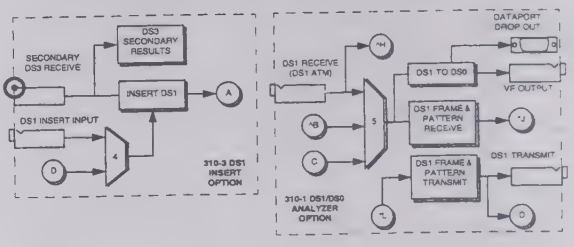
B.2 MAINFRAME, DS3 JITTER OPTION, AND E1 DROP



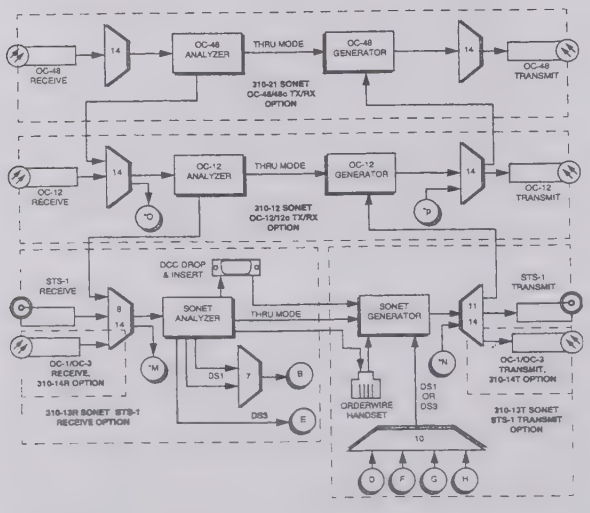
B.2.1 Key

SELECTION	CONFIGURE USING	SELECTION	CONFIGURE USING
1	DS3 SOURCE SWITCH	10	SONET TX-SONET INSERT AUX FUNCTION
2	MODE/RATE & PATTERN/PAYLOAD SWITCHES (DS1 INSERT MODE SELECTS "A")	11	SONET TX-SONET OUTPUT AUX FUNCTION
3	SONET RX-DS1 DROP OUT AUX FUNCTION	12	OPTICAL TEST-OPTICAL PWR AUX FUNCTION
4	PATTERN/PAYLOAD SWITCH WHEN IN DS1 INSERT MODE	13	OPTICAL TEST-STABLE SOURCE AUX FUNCTION
5	310-1 DS1 SOURCE SWITCH	14	ATM RX-RATE SELECT AUX FUNCTION
6	SONET RX-SONET INPUT AUX FUNCTION	*	SONET OPTION CONNECTIONS
7	SONET RX-SONET DS1 CH AUX FUNCTION	*	ATM OPTION CONNECTIONS
8	SONET RX-SONET INPUT AUX FUNCTION		
9	SONET RX-SONET DROP AUX FUNCTION		

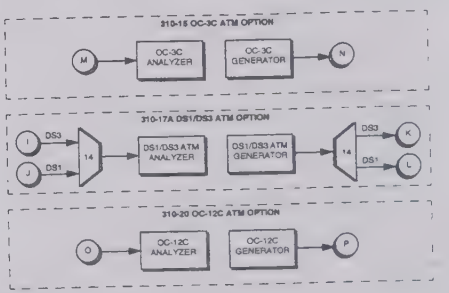
B.3 DS1 INSERT/SECONDARY RECEIVE OPTION AND DS1/DS0 ANALYZER OPTION



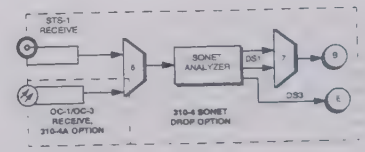
B.4 SONET OPTIONS

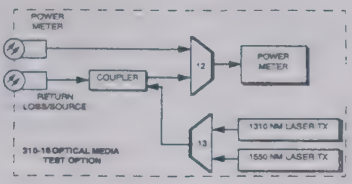


B.5 ATM OPTIONS



B.6 SONET DROP OPTION





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